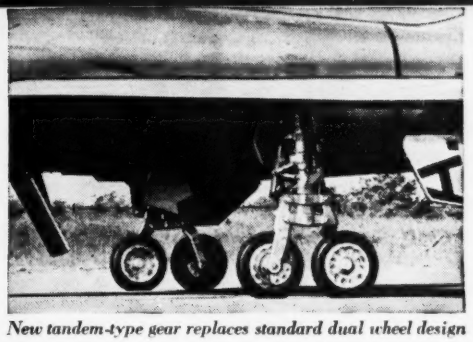
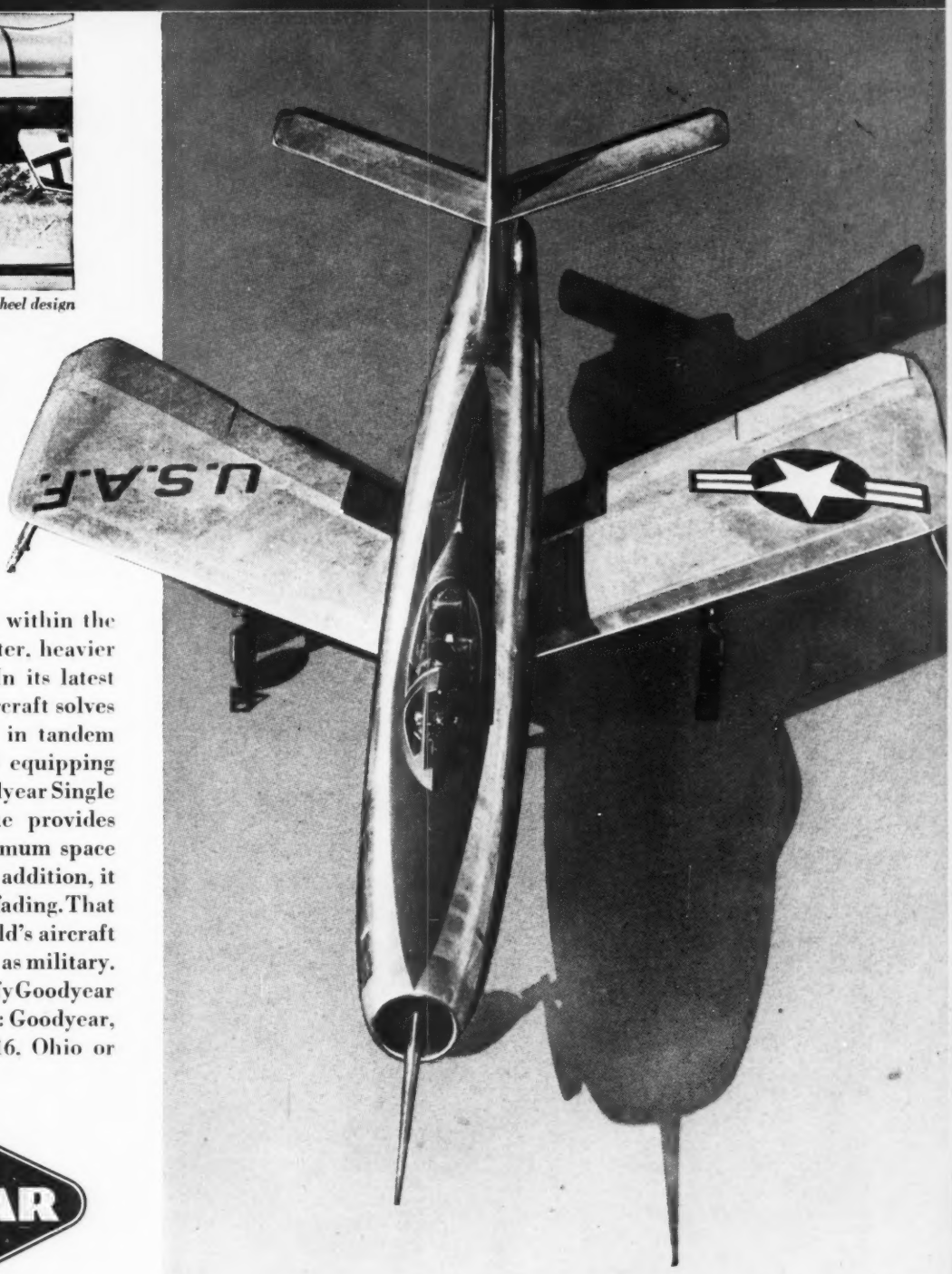
AVIATION WEEK
A McGRAW-HILL PUBLICATION
NOV. 14, 1949



New tandem-type gear replaces standard dual wheel design

Newest way to land a super-jet

HOUSING adequate landing gear within the knife-thin wings of the new, faster, heavier jets is a real engineering problem. In its latest XF-91 jet-rocket fighter, Republic Aircraft solves it by mounting each pair of wheels in tandem (shown in small photo above) and equipping each wheel with a super-compact Goodyear Single Disc Brake. This time-proved brake provides maximum energy absorption in minimum space *–without increasing wheel width!* In addition, it is self-adjusting, self-cooling and non-fading. That is why it is used on so many of the world's aircraft –both private and commercial as well as military. For dependable stopping power, specify Goodyear brakes. To consult our engineers, write: Goodyear, Aviation Products Division, Akron 16, Ohio or Los Angeles 54, California.



GOODYEAR
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PRODUCTS

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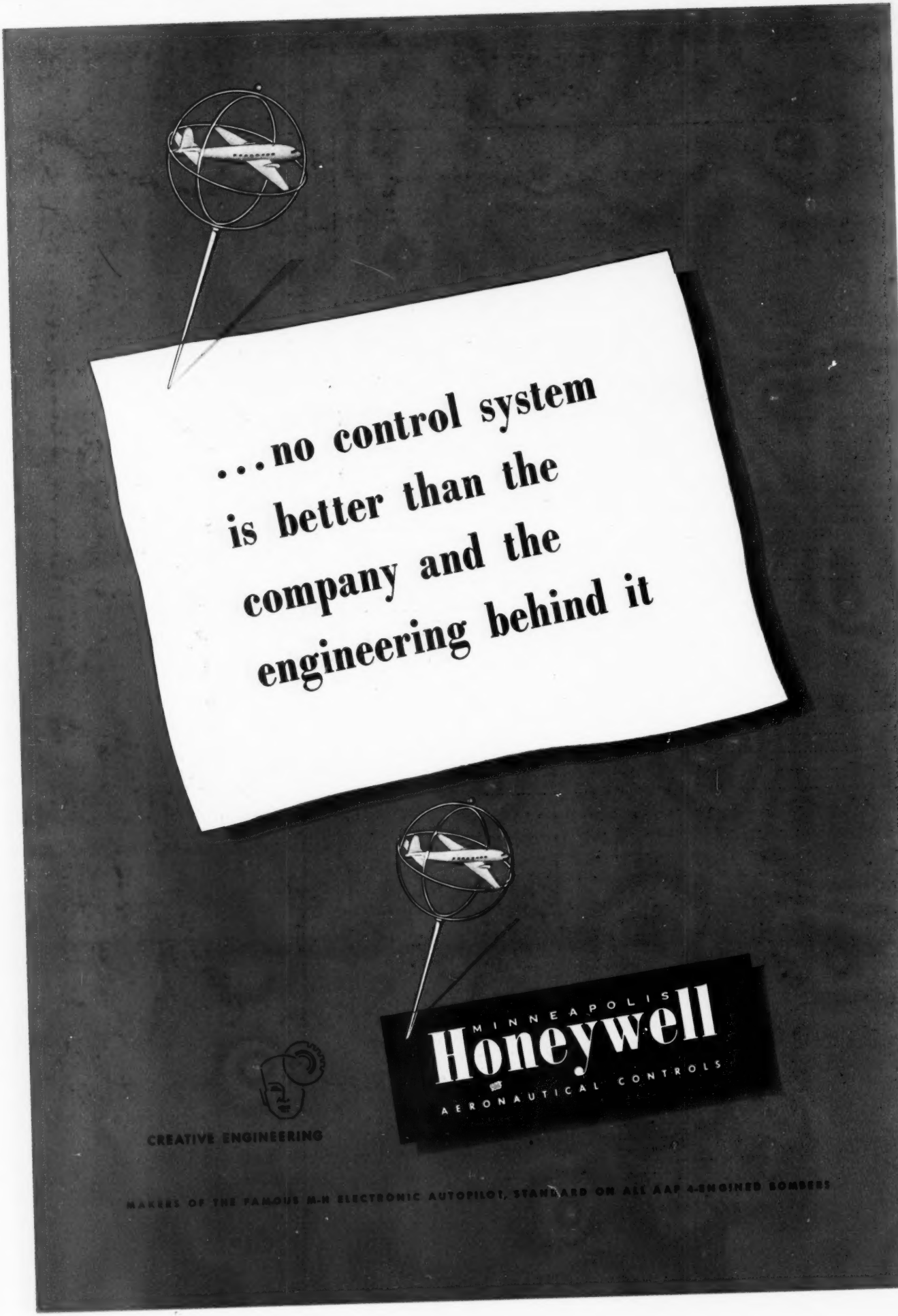
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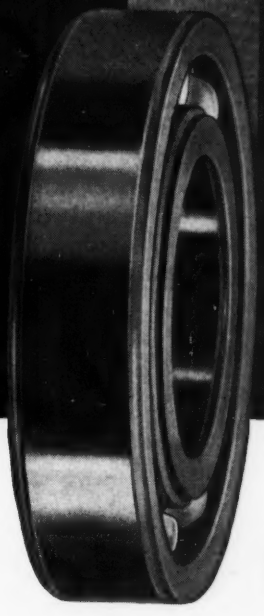

NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

We can't help but be proud of the role we've been asked to play in the development of under-water detection equipment for the United States Navy. Already our Electronics Division has developed and is manufacturing new type Sonar equipment which permits far greater accuracy and precision in this important field.

As a result of this development we now know a lot more about what may be below those angry waves. In the field of aviation, Edo engineers are developing interesting electronic equipment of great significance as well. This same engineering staff is available for the development and engineering of the most advanced electronic devices and equipment and our Electronics Manufacturing Section is prepared to produce it.

Deliveries are now in full progress on the 30 foot A-3 life-boats designed by Edo for the U.S. Air Force to be dropped from B-29's by parachute to survivors at sea. Soon these B-29's of the Air Rescue Service will be stationed at strategic points to extend greatly the areas of potential rescue operations.

In the meantime production of famous Edo seaplane floats continues apace with commercial deliveries going primarily for the four-place Aeronca Sedan, Cessna 170 and 195, and the Piper Clipper.

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College Point, N. Y.
CONTRACTORS TO
U. S. ARMY, NAVY AND AIR FORCE

Aviation Week

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NEW RESEARCH METHODS REVEALED

Unique AiResearch laboratory facilities simulate operations of jet engines for testing of high pressure air cooling turbines

AiResearch laboratory (test cell in inset) where turbines are tested under exact temperatures and pressures encountered in high altitude sonic-range flight

Flying at high altitudes and sonic-range speeds, jet planes generate terrific heat in their cabins. For pilot and crew comfort, AiResearch has developed high speed refrigeration turbines which convert high pressure, high temperature air bled from the jet engines into cool air to cool cabin interiors.

To deliver maximum efficiency, such turbines must operate in *exact ratio* to the pressure and volume of air bled off jet engines. Therefore, in order to test refrigeration turbines before installation, it was necessary for AiResearch to create a laboratory that simulates the actual operating conditions of jet engines.

This unusual laboratory produces exact air bleed-off conditions created by six of the newest type jet engines. Here AiResearch compressors and furnaces manufacture compressed air from 100°F to 1000°F at 100 psi. Special control valves regulate temperature within 1°F and pressure within 2/10 in. Hg. This is another example of AiResearch's ability to exceed in the laboratory the most exacting and critical conditions of flight.

● Whatever your field—AiResearch engineers invite your toughest problems involving high speed wheels. Specialized design and manufacturing experience is also available in creating compact turbines and compressors; actuators with high speed rotors; air, gas and fluid heat exchangers; air pressure, temperature and other automatic controls.

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The Sperry ZERO READER* is a new type of gyroscopic flight instrument. It combines attitude, altitude, heading and radio path information on a simple two element indicator which tells the pilot exactly how to move the flight controls of his airplane.

● Developed by Sperry with the encouragement and cooperation of All-Weather Flying Division, USAF and the Air Transport Association, the ZERO READER takes its place among other Sperry "firsts"— the Gyro-Horizon, Directional Gyro, Gyrosyn Compass and Gyropilot. Like these precision instruments it reflects in its performance the laboratory research and careful flight testing which have contributed to marked advancements in instrument flying.

● The ZERO READER is another example of Sperry's pioneering in equipment to help make air travel increasingly independent of weather for it is the only manual system which approaches the performance of stabilized automatic flight control.

*TRADEMARK—PAT. PENDING

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NEWS SIDELIGHTS

Damon Needles PAA

TWA President Ralph Damon, speaking before the Anglo-American Press Club in Paris recently, had some tart observations about Pan American Airways' policies.

Without mentioning PAA by name, Damon declared that one American group has long cherished the idea that the U. S. should be represented by only one international carrier, namely itself.

"As a step to achieving this ambition it has held forth the bait of unfeasibly low fares. It has frequently proposed, through public announcement, rates so low that its own operations people knew there was no chance of operating successfully under them."

Damon warned that once a monopoly has been established, by underselling and driving its competitors out of business, the monopolist is free to deal with the public as he chooses—to charge exorbitant rates, to provide service, or lack of it, as he pleases.

Johnson Riding High

People who expected Defense Secretary Louis Johnson to pour soothing oil on the troubled Pentagon waters are due for another guess. Unabashed by the bitter criticism of his action in removing Admiral Louis Denfeld as Chief of Naval Operations, Johnson is publicly boasting that he was called worse names when he was Assistant Secretary of War in 1937, and has renewed his promises to continue house cleaning in the Defense Department.

Johnson recently made a bitter attack on wastefulness in the Navy before a group of civilian industrialists attending a procurement seminar in the Pentagon. A few days later in Cleveland he lashed out at "die-hards and dreamers" among professional military men and defended his defense program aimed at cutting the military budget.

Plant Security

Watch for the Defense Department to tighten security and plant protection requirements for contractors working on military orders. Munitions Board is publishing a new security guide for contractors. Entitled "Principles of Plant Protection," it will be available from the Government Printing Office early next year. It will be the first in a new series of manuals aimed at acquainting contractors with their responsibilities and how to meet them.

Navy Shift

Regime of Admiral Forrest Sherman as Chief of Naval Operations is expected to provide the flying Navy with a better break than it received under the regime of submariner Louis Denfeld. Sherman is the first Naval aviator to hold the post and has definite ideas as to what Naval aviation can and can't do. There will be less pushing to encroach on the USAF domain of strategic bombing and more development of the primary Navy mission of anti-submarine warfare and support of Naval forces.

MATS Future

Military observers wonder how much longer the Navy will be able to maintain a contingent in the Military Air Transport Service. Navy's fleet of Douglas R5Ds, like the USAF Douglas C-54 fleet, is rapidly wearing out. Since the Navy is not buying any new transport types, except for airborne Marines, it will have little to contribute to MATS after the R5Ds are gone. With no Navy planes in MATS it would appear logical to eliminate significant Navy participation in the Air Transport Service. Watch for renewed efforts to have the Navy's fleet logistics support wings now operating the Martin Mars and some R5Ds and RRDs added to MATS.

Pilot Pay Aims

Air Line Pilots Assn. President Dave Behncke, pointing to technological unemployment among his union's members, is proclaiming that mileage limitation is a "must" in future contracts. As the largest domestic carriers, American Airlines and United Air Lines are Behncke's prime targets.

ALPA concedes there is considerable managerial resistance toward the mileage limitation proviso, which could cause a sizable increase in the carriers' flight expense. Management feels that it should not be penalized by "featherbedding" rules after it has laid out millions of dollars for bigger, faster and more productive postwar aircraft.

Behncke claims that because of the new planes, American's pilot roster has been cut from about 1200 to 800, while UAL has thinned its pilot payroll by 150 men. He says the pilots and federal officials recognized the threat of technological unemployment when the National Labor Board set forth the basic pilot pay structure in 1934.

Under NLB's decision 83 in that year, an 85-hours-a-month flight time limit was placed on airline pilots, but the Board decided "experience had not crystallized sufficiently to put a maximum on monthly mileage." Now Behncke sees 500-mph. jet transports in the offing and wants action.

Omni Move

CAA is offering VHF omni-range ground stations to European countries on a long-term lease for a nominal fee in a move aimed at standardizing air navigation facilities in Europe along the American pattern. Biggest competition is from the British Decca system.

Specifications for manufacture of airborne receivers to use the omni-range system are being given to European radio manufacturers so they will not be dependent on U. S. airborne equipment that would require dollar purchases. CAA feels that the possible loss in manufacturers' business by this move will be more than offset by the advantages of a standardized air navigation system.

Henderson Likes B-36

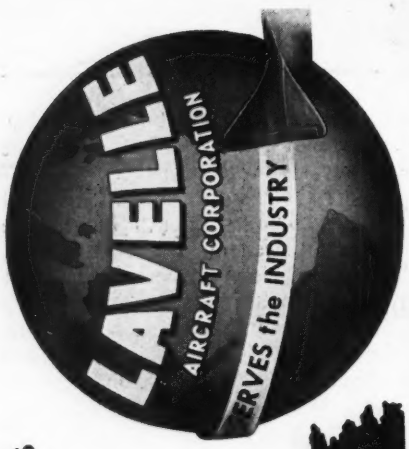
British Secretary of State for Air Arthur Henderson recently stepped, probably unwittingly, into the big U. S. inter-service squabble over the merits of the B-36. In a press interview at Maxwell Field, Ala., he called the B-36 "undoubtedly the best bomber in the world at the moment."

Interviewed by a local reporter Henderson told him that the B-36 "in its performances borders on the fantastic." Henderson has been making a tour of USAF installations during a visit in this country.

UAW-IAM Peace

Bitter union jurisdictional fights between United Auto Workers and International Assn. of Machinists, such as in the past have plagued Martin, Ryan, Convair and others, may be over.

UAW and IAM have signed a "non-aggression" pact, pledging each to respect the contracts of the other, and to refrain from soliciting the other's members or doing anything else to disturb the contractual rights of the union already in a plant. These are the two unions that have vied for leadership in the nation's aircraft plants.



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AVIATION CALENDAR

Nov. 15-16—Airport fire protection conference and demonstration, sponsored by CAA Region One, Hotel Lexington, New York City.

Nov. 15-16—Plastics seminar, sponsored by the Society of the Plastics Industry, Shoreham Hotel, Washington, D. C.

Nov. 16-18—Annual meeting, National Aviation Trades Assn., New Orleans.

Nov. 28-Dec. 2—70th annual meeting, American Society of Mechanical Engineers, Hotel Statler, New York, N. Y.

Nov. 29-30—Air Traffic Conference final meeting for 1949, sponsored by Air Transport Assn., Edgewater Beach Hotel, Chicago.

Nov. 30-Dec. 2—Annual meeting, Society for Experimental Stress Analysis, Hotel New Yorker, New York.

Nov. 30-Dec. 2—Kansas Airport and Aerial Spray Conference, Manhattan, Kansas.

Dec. 9-10—First Convertible Aircraft Congress, sponsored by Philadelphia chapter of IAS and American Helicopter Society, in Philadelphia.

Dec. 15-16—Air Transport Assn. board of directors annual meeting, Carlton Hotel, Washington, D. C.

Dec. 15-17—National aviation meeting, sponsored by the National Aeronautic Assn., Washington, D. C.

Dec. 16-17—1949 national aviation meeting, organized by the National Aeronautical Assn., Hotel Statler, Washington, D. C.

Dec. 17—Institute of the Aeronautical Sciences 13th annual Wright Brothers lecture, U. S. Chamber of Commerce Building auditorium, Washington, D. C.

Dec. 31-Jan. 7—"Winter WingDing," sponsored by the Mount Plymouth Hotel and Golf Club, Mt. Plymouth, Fla.

Jan. 11-12—Florida Flying Alligator Club's Annual Rituals & Frolics, Melbourne, Fla.

Jan. 13-15, 1950—All American Air Maneuvers, Miami.

Jan. 16-17—Miami-Havana Air Cruise for private planes, conducted by Florida Air Pilots' Assn.

Jan. 16-19—Plant Maintenance Show, sponsored by American Society of Mechanical Engineers and the Society for the Advancement of Management, Cleveland Auditorium, Cleveland.

Jan. 17-19—University of Illinois second annual Custom Spray Operators school, Urbana, Ill.

Jan. 23—IAS annual Honors Night dinner, Hotel Astor, New York, N. Y.

Jan. 23-26—IAS 18th annual meeting, technical sessions, Hotel Astor, New York, N. Y.

Jan. 24—Ninth session, ICAO Council, Montreal.

Feb. 18-26—National Sportsmen's Show, Grand Central Palace, New York, N. Y.

PICTURE CREDITS

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NEWS DIGEST

CAA Tower Control

At Air Force request CAA last week assumed control of all military flying on federal airways as well as civil flying. Previously CAA had controlled military flying on airways in bad weather only.

Step followed a joint conference of Air Force, Navy and CAA representatives seeking to lessen hazards of collisions between military and civil planes.

New urgency for a solution to this hazard was given by Eastern Airlines Constellation pilot's report of a near-collision near Washington National Airport with a B-25 from Bolling AFB.

Transport pilot said the bomber passed over the Constellation from the rear within 50 ft. as the transport was climbing from takeoff to an assigned altitude on the airway to Atlanta. The airliner carried 49 passengers and a crew of 5. The Air Force pilot said he was making a simulated instrument approach to Bolling, and no one in the Air Force plane saw the Constellation. Order suspending all simulated instrument flying by military planes in Bolling area was issued pending further investigation. Near-collision happened just a week after a P-38 piloted by a Bolivian collided with an Eastern DC-4 landing at Washington Airport, resulting in deaths of all the airliner's passengers and crew, 55 persons.

DOMESTIC

Convair has received a USAF order for 12 additional T-29 navigational trainers, bringing total order to 48. New contract amounts to approximately $5.2 million and includes spare parts. First completed trainer is scheduled for delivery to the Air Force early in 1950.

Karl Compton has resigned as chairman of the Defense Department's Research and Development Board because of failing health. Dr. Robert F. Rinehart is carrying out his duties as deputy chairman, although no successor had been named by midweek.

J. R. "Bud" Harrington a member of the three-man National Aviation Trades Assn. advisory committee in 1947-48, was killed in a recent crash near Canton, Ohio.

Slick Airways is currently operating two Noorduyn Norsemen on short-haul feeder routes in California, each with a 2000-lb. capacity. If the experiment works out, the carrier will acquire more of the single-engine Noorduyns. Slick now has made firm commitments for three DC-6As, cargo versions of the DC-6.

FINANCIAL

Republic Aircraft Corp. reported net income, after federal and state income taxes, of $414,100 for the nine months ended Sept. 30, 1949. Amount is also after provision for contingency reserve of $180,000. Sales for the nine months totaled $26,597,503. Backlog is $49 million. Net income includes reimbursement of claims previously disallowed under cost-plus-fixed-fee contracts terminated in previous years, amounting to $339,893 after applicable federal and state taxes.

Curtiss-Wright Corp. and subsidiaries reported net income for the three months ended Sept. 30, of $955,308, and a consolidated loss of $954,001 for the nine months ended Sept. 30 on income. Consolidated net sales for the three months were $27,913,051; for the nine months, $87,821,689. Unfilled orders total $132.8 million, compared with $137.5 million at June 30, 1949.

INTERNATIONAL

TACA Airways, S. A., has issued 491,286 additional shares of capital stock to liquidate debts totaling $2,456,000. Issuance of the additional stock brings the amount outstanding to 2 million shares, the total authorized issue.

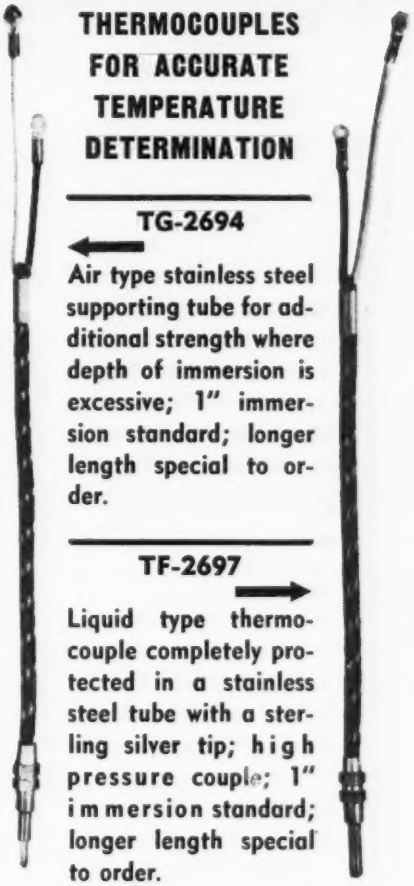
Britain finally agreed to accept a U. S. offer of 70 B-29s as part of the military assistance program of the North Atlantic Pact, after earlier British discussions found military strategists split on advisibility of accepting the craft. Some officials argued the B-29s would put too great a strain on the depleted RAF because of their increased operating expenses, engineering maintenance and crew training.

Six Brazilian companies have been authorized by the Civil Aeronautics Board to import 29 aircraft from the U. S.: Dias Henrique & Cia., one Navion; Aviquipo do Brasil, 15 Aeroncas; Varig, two C-47Bs; Cia. Carnasciali, Industria e Comercio, six piper PA-16s; Valivas, Importaco e Exportaco Comercio, three C-46s; Linhas Aereas Transcontinentais, two aircraft.

Colombia is conducting its air navigation facilities, airports and air traffic control procedures with CAA's DC-3, equipped with cross-wind landing gear. Colombia pays for cost of the operation.

Revere

THERMOCOUPLES FOR LIQUID AND GAS TEMPERATURES



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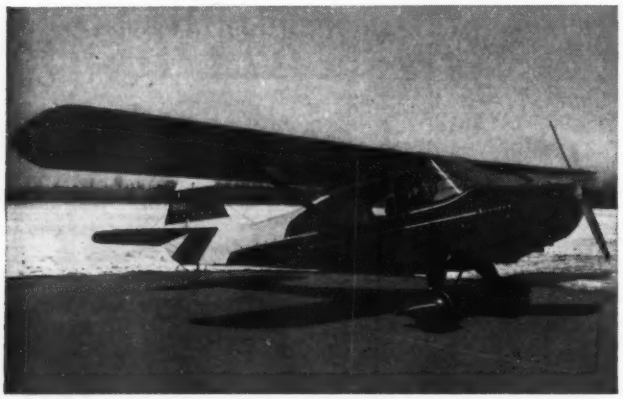
2. DEPENDABLE—the *Ryan Navion* . . . streamlined, sleek, amazingly easy to fly, it's able to make extremely short take-offs and landings.



3. DEPENDABLE—the *Aeronca Sedan,* a full-size, four-place airplane engineered to give excellent small field performance.

4. DEPENDABLE—the *Swift 125,* featuring semi-monocoque military construction throughout. Big-plane utility, light-plane economy.

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WHO'S WHERE

Changes

A top-level shakeup at Lockheed Aircraft Corp. subsidiaries brought in **Daniel J. Haughton** as president of Airquipment Corp., wholly-owned subsidiary, and Aerol Co., Inc., an Airquipment subsidiary. He replaces **Newman L. Smith,** resigned. Haughton has been assistant to the vice president-manufacturing at Lockheed for several years. **Burt C. Monesmith** replaces Haughton as assistant to the vp-manufacturing of Lockheed. **G. A. Fitzpatrick,** former superintendent of Lockheed's jet fighter production, replaces Monesmith as Lockheed works manager. Airquipment Corp. manufactures aviation ground-handling devices and maintenance equipment; Aerol Co. manufactures and distributes aluminum products, among them industrial material-handling equipment.

Appointments

Marshall F. Allen, formerly executive secretary of National Aircraft Standards Committee, now is manager of the Magnesia Insulation Manufacturers Assn. . . . **J. H. Berry** fills the newly-created post of director of manufacturing for A. V. Roe Canada Ltd., Toronto. He's responsible for coordination of all gas turbine and aircraft manufacturing activities.

Trans World Airline named **J. L. Brumit** administrator of credits. He was formerly assistant to the director of accounting. . . . American Airlines transferred **Marvin Whitlock** to Tulsa where he becomes assistant director of the engineering division. He was formerly with AA's aircraft and service engineering division in New York.

Bonanza Air Lines is setting up key executive posts in readiness for activation of its Reno-Phoenix route before Christmas. Latest appointments: **Michael E. Cole,** vp-traffic sales; **Hugh B. Johnson,** vp-operations; **Myron W. Reynolds,** chief pilot; **Earl E. Jochim,** chief accountant; **John A. Sullivan,** superintendent of stations.

Western Air Lines board of directors elected **Arthur F. Kelly** vp-sales. . . . Chance-Vought named **Fred N. Dickerman** chief engineer and **Raymond C. Blaylock** chief of design. Dickerman was formerly an assistant chief engineer; Blaylock was chief engineer of Curtiss-Wright's Airplane division in Columbus.

Elections and Honors

Tom Bell, TWA's PR manager in Washington, was named general chairman of the annual Wright Day dinner Dec. 17. . . . **Ralph S. Damon,** TWA president, will serve as chairman of the aeronautics division of the 1949 United Hospital Campaign. . . . **Hans M. Omenitsch,** officer of World Resources, Inc., aviation consultants, was awarded the Order of the Black Star, rank of Chevalier in the Legion of Honor by France for his direction of rescue operations in finding 12 French dignitaries forced down in the Liberian jungles.

INDUSTRY OBSERVER

► **North American Aviation Inc. has received a new Navy order for 15 additional AJ-1 trimotor attack planes. This brings total AJ-1 production up to 55 planes, with the first production models already in Navy squadron service and scheduled for a Midway-class carrier. The AJ-1 is powered by two Pratt & Whitney R-2800 piston engines and an Allison J-33 turbojet.**

► Experiments with titanium for armor plating may point the way toward significant weight savings in combat type aircraft. Test conducted by the Army Ordnance department, which is developing titanium tank armor, revealed that titanium may be able to do a better job of protection than steel with a 40 percent weight saving. Titanium still costs $7.50 a pound in ingot form.

► **Watch for efforts to establish a closer liaison between U. S. Air Force and the Royal Canadian Air Force on aircraft winterization methods. Canadians don't lean too heavily on use of heaters for start-up and stress engine oil dilution procedures. Wing covers are another important factor in Arctic operation requiring special material and precise fit to avoid freezing to aircraft surfaces.**

► Republic F-84 Thunderjets which recently flew across the Atlantic to England are being used for adapting British aerial refueling techniques to this type fighter. The Thunderjet's new role as a heavily armed low-level attack plane for support of ground troops means it will need more range and the ability to stay in a target area longer than its present fuel capacity permits.

► **Glenn L. Martin Co. is studying the possibilities of putting turboprop power into a modification of its Model 2-O-2 transport design. Old competition between the Convair-Liner and the Martin 2-O-2 in the medium-haul transport market may revive between turboprop versions of both airframes.**

► Howard Hughes is running a flight competition between the Martin and Convair transports at his Culver City Airport. This may be the first step in solving TWA's DC-3 replacement problem. Convair has 15 of its Liners completed and ready to sell. Martin's 2-O-2 line has not yet turned out any finished transports.

► **Some conservative American structures engineers are dubious about the long-range reliability of metal bonding processes in high altitude aircraft. They believe long exposure to low temperatures may affect the bonding characteristics of the metal glue. Metal bonding is used on the de Havilland Dove and Comet and on the Convair B-36 series.**

► Airlines using the Convair-Liner have begun a modification program to beef up the tail structure. Stiffeners are being installed according to Convair-supplied plans. Service experience indicated fairly severe stresses developed during tail buffeting caused by propeller slipstream during certain flight attitudes. Installation of stiffeners is purely a preventive measure since no tail trouble has been actually encountered on aircraft in service.

► **Proposal under consideration by CAB to standardize civil aircraft cockpits based on military aircraft cockpit standards is meeting opposition from the aircraft industry. Contention is that cockpit arrangement should not be frozen by regulation. Industry advocates instead voluntary airline-industry engineering cooperation on the problem. It is pointed out that even Air Force and Navy procurement can permit some deviation from their standards which would not be possible for civil aircraft if the standardization were frozen in regulatory requirements.**

► High altitude research by W. A. Watterson, chief test pilot for Gloster Aircraft, has raised some interesting questions as to how high turbojet airliners will have to cruise to really fly "above the weather." Watterson has been doing high altitude weather research up to 50,000 ft. in Meteor fighters. He reports that cumulo-nimbus clouds have been encountered as high as 38,000 ft., although meteorologists seldom forecast them above 23,000 ft. Winds up to 180 mph. and severe turbulence were frequently encountered in clear air above 30,000 ft. Heavy icing conditions were found in the clouds up to 38,000 ft.

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AVIATION WEEK

Nov. 14, 1949

Industry Asks New Cargo Plane Category

Proposal once defeated domestically is put before International Civil Aviation Organization.

By Alexander McSurely

A new international cargo transport category boosting operating weight 5 percent over that allowed for passenger planes has been proposed to the International Civil Aviation Organization by the U.S. aircraft industry.

The category, if accepted, would permit an estimated increase in cargo payloads of approximately 20 percent.

I. C. Peterson, Aircraft Industries Assn. technical director, proposes the increase in operating weight in a letter to the Air Coordinating Committee for forwarding to ICAO, contending that the action would be preferable to establishment of new transport categories ICAO has under consideration.

▶ **Renewed Effort**—This renewal of industry effort to bring about a more favorable rating for cargo planes follows previous defeat of a similar proposal when Civil Air Regulations Part 04—which sets up the present transport category—was written.

Earlier efforts for a special cargo category met strong opposition from the Air Line Pilots Assn., which contended that the proposal meant greater hazard for the crew.

Larry Cates, ALPA's Washington representative, told that his organization would take the same position if the proposed change in category is reintroduced.

▶ **Cargo Considerations**—Peterson contends in his presentation to ICAO that special design features and operating techniques could be used with a cargo plane which are not practicable in a passenger transport and should be taken into account in fixing the maximum safe operating weight.

Among these he cites:

• **Load distribution** to locate center of gravity in most favorable position for stability and control is practical with cargo but impractical in a passenger plane in which passengers move about during flight.

• **Cargo payload** can be tied down for protection against rough air, sharp maneuvers or hard braking and requires no special attention at such times, as do passengers.

• **Cargo crew members** have only themselves to consider in emergency, not additional responsibility for passengers.

• **Special safety features** for crew can be incorporated. These include special seats, crash bulkheads, harness-type safety belts, parachutes and other devices which would not entail a large penalty in the airplane's empty weight if installed only for crew. (Specifically cited is the recently developed Navy fighter plane seat and attaching structure with a 40-G load requirement, compared to structural requirement for commercial passenger plane of approximately 6-Gs.)

• **Cargo may be jettisoned** either all or in part, under emergency conditions over open terrain or water, as an added safety feature to increase rate of climb. This has proved practical in military operation but can't be used, obviously, in passenger operation.

• **Limitations on altitudes** and rates of descent for passenger comfort need not apply to a cargo plane when, for example, a rapid descent is required to combat icing conditions.

• **If the cargo plane needs to use** higher-than-normal rated engine power in emergency during takeoff or enroute in flight, carriers can offset this by more frequent engine overhaul periods or more exacting engine maintenance.

▶ **Slower Speed Safety**—Peterson states that the airworthiness standards should take into account all practicable aspects such as risk to third parties.

Except for takeoff and landing, he points out, the cargo plane loaded 5 percent heavier than the passenger transport will approximate the same risk, since its average speed will be somewhat less. The lower speed will mean less severe stresses as a result of occasional critical gusts, and will be more economical because of reduction in horsepower over cruising power now used in passenger carrying.

The overload is aimed at balancing with economic feasibility the increased margin of safety realized by reduced speed of operation. Computations indicate that the balance is not precise for all airplanes but the approximation is within the accuracy of design criteria.

Peterson reports that many well-qualified engineers believe the 5 percent overload figure for cargo is conservative, and later can be modified upward progressively.

▶ **Sees Precedent**—"It is not possible to disassociate flying safety from economy of operation, although this relation has not been acknowledged frankly at any of the ICAO meetings," the AIA spokesman wrote.

"Instead technical representatives of ICAO member states have spoken loosely of a category system in which all operations, irrespective of equipment, terrain or flight conditions, would provide the equivalent to some arbitrarily specified highest possible level of safety. Factors involved in aircraft design and operation are not amenable to rational comparisons. Unless authorities are willing to recognize different levels of operational safety there can be no satisfactory solution.

"The solution to the problem of categories is principally one of operations and not airworthiness. This concept has already been recognized in CAR Part 3 in which we have normal, utility and acrobatic categories, which allow the same airplane to fly at markedly different gross weights depending on type of flight operation involved."

▶ **Airworthiness Tips**—Peterson recommended in respect to the proposed three ICAO categories for airworthiness:

• **Only transport Category A,** the highest standard of performance safety, should be established.

• **No single-engine aircraft** or twin-engine aircraft without single-engine performance should have ICAO airworthiness standards. Instead, it is suggested that ICAO recognize domestic airworthiness certification of single-engine aircraft as valid for international use for hire. This might be subject to ICAO operational limitation, such as requirement of special instruments if an airplane is being flown under special conditions. This would eliminate Category D.

• **Category C,** with lower standards than Category A, should be eliminated and its performance safety level adjusted upward to the latter.

• A separate cargo category (as previously described) should be added.

"The aircraft manufacturers believe

that certain basic principles should be established and agreed upon before the U. S. enters into any further discussions with other nations on detailed ICAO airworthiness or operational standards that would apply to aircraft engaged in international operation in carrying passengers or goods for hire," Peterson stated.

"A manufacturer obivously desires to design and construct his product so that it will have the greatest possible utilization.

"In all instances the state of the art of aircraft design will largely govern the inherent abilities and characteristics of a new aircraft rather than several arbitrary sets of minimum international airworthiness standards.

"The aircraft manufacturer, therefore is not interested in having more than one set of standards. Any lesser degree of permissible performance for that type of airplane should be recognized and achieved from the operational point of view."

Airlines Will Top Peacetime Peaks

Revenue passenger mile jump of 15 percent during 1949 is key to current $25 million estimated operating profits.

By Charles Adams

Showing the best financial improvement over last year of any major segment of U. S. industry, the domestic trunk airlines entered the last two months of 1949 with estimated operating profits of $25 million and a net of $15 million.

Earnings are unlikely to be increased much during November and December because of the normal seasonal traffic decline which is being accentuated by the recent Eastern Air Lines accident at Washington. Even so, the best peacetime earnings in history are now assured.

▶ **Passengers Gain**—Key to the record profits is the 15 percent jump in revenue passenger miles flown by the 16 domestic trunklines during the first nine months of 1949. Of comparatively minor importance from the profit standpoint were the even larger gains shown in freight and mail volume.

Early fall traffic was excellent. Whereas revenue passenger mileage was up 14.24 percent over 1948 during the first eight months of the year, the gain was 16 percent for September alone.

▶ **Profit Leaders**—Aided by heavy summer profits, American Airlines and United Air Lines passed Eastern Air Lines in the earnings parade.

American showed a systemwide operating profit of $8,404,000 and a net of $5,934,000 in the first nine months of 1949. In the same period last year its operating loss was $2,654,000 and its net loss was $3,416,000.

Including its profitable West Coast-Hawaii service, United earned an operating profit of $5,738,000 and a net of $2,710,000 in the first three quarters of 1949. Last year the carrier was slightly in the red for the same period.

Mail pay increases contributed little or nothing to the industry's financial comeback. United's mail pay dropped from $5,929,000 in the first nine months of 1948 to $5,120,000 this year. American's mail pay was up slightly from $3,177,000 to $4,026,000.

▶ **Unit Costs Fall**—By contrast, United's passenger revenues increased nearly $9 million and American's more than $11 million. AA's total revenues for the first nine months of 1949 were 21 percent ahead of 1948, while expenses per revenue ton mile flown were cut from 55 cents to 46 cents. UAL's revenue ton mile operating costs dropped from 51.7 cents last year to 43.8 cents in the first three quarters of 1949.

United had 9918 employees as of Sept. 30, a cut of 1400 from a year before despite the increased traffic volume.

Both American and United reported good business during October, and AA's profit for the month may approach September's high level.

• **Northwest Airlines** announced that September was its sixth consecutive month in the black. On combined domestic and international operations, NWA showed a net profit of $1,984,000 during the first nine months of 1949 against a net loss of $2,120,000 in the like period last year.

President Croil Hunter doesn't expect his company to make any substantial profit in the fourth quarter. But with the improved dependability of winter service plus new business developed by the Stratocruisers he does not anticipate any serious losses.

SKI-SHOD NEPTUNE FOR THE ARCTIC

Aluminum skis which are retractable in flight and fit over the wheels of its regular tricycle landing gear are featured on the Navy Lockheed Neptune, designed for Arctic operations. Skis are tucked inside a fairing underneath the engine nacelles. This P2V is specially fitted with super-sized heaters, a sun-compass, special radio and radar for use near the magnetic poles, and additional fuel tanks for extra-long range operation. Rocket-like object protruding from the tail is "experimental electronic device."

Contributing importantly to Northwest's high traffic volume has been its New York-Seattle coach service, on which load factors averaged 88 percent during the six months ended Sept. 30. NWA freight revenues in the first three quarters of 1949 soared 126 percent over the 1948 level.

• **Eastern Air Lines** showed a net profit after taxes of $1,361,136 for the first nine months of 1949, compared to $762,578 for the same period in 1948. For the six months ended June 30, 1949, Eastern had shown a net profit of $2,148,361.

Medium-sized and small trunklines shared in the revenue and traffic boom.

• **Capital Airlines** had a $1,061,000 operating profit and a $1,326,000 net profit in the first nine months of this year. For the same 1949 period its operating profit was $621,000 and its net was $92,000. Although mail pay fell $422,000, total operating revenue was up $2,890,000 during this period.

President J. H. Carmichael disclosed that revenue passenger miles on regular-fare flights totaled 216 million, up 10 million over the first three quarters of 1948. In addition, the company flew 56 million coach revenue passenger miles. Capital's four-cents-a-mile coach operations began in November of last year.

• **Chicago & Southern Air Lines'** nine months systemwide operating profit was $1,055,000—nearly double the $553,000 reported last year. Net income rose from $449,000 to $509,000. About $120,000 of the net was derived from international operations.

• **Mid-Continent Airlines** upped its nine months net to $263,000 against $80,000 in the like 1948 period.

• **Northeast Airlines'** operating profit of $173,000 compared with an operating deficit of $738,000 in the first three quarters last year.

XB-52 Plans

Boeing Airplane Co. will get a USAF contract for ten XB-52 jet bombers after two experimental planes have been completed and accepted by the Air Force, Congressman Hugh B. Mitchell has declared in Seattle. Mitchell gave Air Secretary W. Stuart Symington as his source of information.

Mockups of the craft are now being completed by Boeing. Production, according to Mitchell, will be at Seattle, and spread over a four- to seven-year period, beginning in 1952.

Changes To Simplify Renegotiation

New Rulings: Renegotiation on contracts over $1,000 only; exemption from provisos of Vinson-Trammel Act.

By Robert Hotz

Two major changes in the renegotiation procedures for fiscal 1950 will simplify matters for aircraft manufacturers and subcontractors working on military business.

These changes are contained in Section 622 of the fiscal 1950 military appropriation act which recently became law with President Truman's signature. They are:

• **Only negotiated contracts** in excess of $1000 are now subject to renegotiation. Formerly all types of contracts for aircraft procurement with funds authorized by Public Law 547 (80th Congress) were subject to renegotiation.

• **All contracts subject** to renegotiation are exempt from the profit limitation provisions of the Vinson-Trammel Act of 1934. This in effect eliminates double jeopardy on profit limitation. The action is retroactive to May 21, date of enactment of the Renegotiation Act of 1948. Reports from contractors subject to the Vinson-Trammel Act were due Sept. 15 for the last fiscal year, but special arrangements have been made with the U. S. Treasury so that contractors subject to renegotiation no longer have to file these reports with the government.

First renegotiation under the 1948 act on contracts let during fiscal 1949 is now under way in the Pentagon. It is being handled by the Air Force, Navy and Army divisions of the Armed Services Renegotiation Board. Division chairmen are: Frank L. Roberts, USAF; Richard L. Cross, Navy; and Brig. Gen. Ernest M. Brannon, Army.

▶ **Policy Board**—The three chairmen also form the military Renegotiation Policy and Review Board which establishes regulations, interpretations and administrative procedures for applying the renegotiation act; sets standard for determination of excessive profits; and rules on appeals from decisions of the three service boards. Final rulings of the policy board may be appealed to the U. S. Tax Court.

To aid prime contractors and subcontractors in determining their position under the act, the policy board publishes a list in the Federal Register of all contracts specifically subject to renegotiation. A new list covering contracts let up to June 30, 1949, will be published within a few weeks.

▶ **Individual Standards**—Renegotiation policy makers emphasize that there is no set standard or percentage on what is a "reasonable profit" allowed by the law. They say that every case will have to be judged on its individual merits based on the following main considerations:

• **Efficiency.** Pentagon officials maintain that they do not wish to penalize efficient operations through renegotiation and that the efficiency of a manufacturer will be a strong factor in determining his "reasonable" profit level.

• **Reasonableness of costs and profits.** Here again the standard can only be determined by examination of the manufacturer's entire picture in relation to his military business.

• **Capital employed** and net worth.

• **Extent of risk assumed.** Bigger risks, generally will be assumed to require larger profits.

• **Contribution to national security.** More weight will be given to work that involves research and development factors that make a contribution to defense progress and production that is of a vital nature and cannot be obtained elsewhere.

• **Character of business.** An example of this criterion is the difference between manufacturers, subcontractors and prime contractors who function mainly as assemblers of parts made elsewhere. Actual renegotiation operations are conducted by three types of personnel: Board members, renegotiators and financial analysts. Board members make the actual determination of whether a firm's profits are excessive.

▶ **Plan Visits**—Where possible a team will visit contractors' plants but since the boards do not maintain field offices, contractors' representatives will be required to come to Washington for consultation with the board and its teams.

Pentagon officials stressed that everything possible would be done to keep the administrative burden of renegotiation at a minimum for the contractor. Where there is a concentration of business subject to renegotiation, as in the Los Angeles area aircraft plants, it may be possible to hold regional meetings to eliminate individual travel to Washington.

▶ **Appeal Rights**—In the event a contractor's representatives and the board cannot agree on settlement of a case the government has the right to take unilateral action. The contractor can then appeal from the board to the Policy and Review Board. Full dress review of the case will be conducted by the policy board, which has authority to alter the decision of the three service boards. If a contractor is still unsatisfied, he has the right to appeal to the U. S. Tax Court.

EAL Crash

CAB member joins in Board's most intensive accident investigation

Formal investigation into the cause of the nation's worst commercial air disaster—the crash of an Eastern Air Lines DC-4 near Washington, D. C., National Airport on Nov. 1—was slated to get under way in Washington last week.

The probe into why the P-38 fighter, piloted by Eric Rios Bridoux, Bolivian director-general of civil aviation, plunged into the transport during the latter's final landing approach, will be the most extensive in CAB history. The eight-day interval between the accident and opening of formal hearings was the shortest on record for such proceedings.

▶ **Jones on Panel**—CAB member Harold A. Jones, a Marine combat pilot in World War I, is serving on the inquiry panel headed by Robert Chrisp, chief of the Board's hearing and reports division. Only twice before has a Board member sat in on an accident investigation.

While all preliminary evidence pointed to Eastern's complete freedom from blame in the mishap, no conclusions have yet been reached. Whether Bridoux had any power or mechanical failure prior to the collision, whether CAA control tower operators correctly carried out their duties, and whether a B-25, making simulated landings at Washington National Airport just prior to the crash, confused Bridoux will be major subjects of inquiry.

▶ **Deposition Expected**—CAB safety officials expected to be able to introduce into the hearing a complete deposition from Bridoux, who last week was recovering from serious injuries.

A statement by D. W. Rentzel, CAA administrator, exonerating EAL from blame in the accident, was described as premature by CAB representatives, who pointed out that any official findings must be made by the Board. Reportedly under pressure from top Commerce Department officials, Rentzel had declared that the crash was "beyond the control of Eastern, which was operating in conformity with all safety rules."

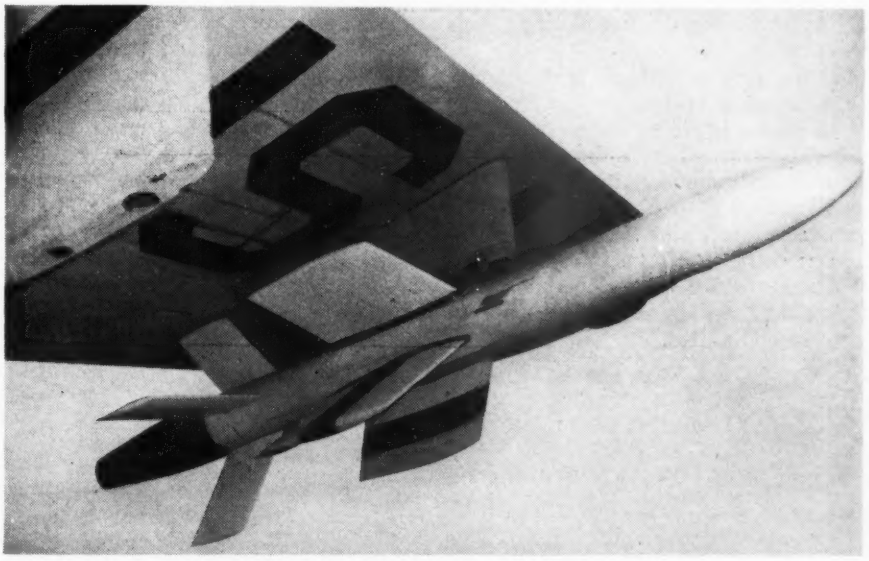
▶ **Reforms Urged**—Congressional demands for new safety measures grew as a result of the EAL mishap. Sen. Edwin Johnson (D., Colo.), chairman of the Senate Interstate and Foreign Commerce Committee, urged new curbs on military plane flights on commercial airways. Rep. Robert Crosser (D., Ohio), chairman of the House Interstate and Foreign Commerce Committee, called for "exacting requirements" in the exchange of messages between control towers and aircraft.

Rep. Carl Hinshaw (R., Calif.), suggested that all military aircraft be removed from Washington National Airport to nearby military fields to relieve congestion. (There was no traffic congestion at the time of the EAL accident, and the weather was clear.)

▶ **Behncke Comments**—Air Line Pilots Assn. President David L. Behncke recommended "fundamental changes in air traffic procedures and use of fields which will give scheduled airliners right of way priority over all other planes." Airline aircraft have never been given proper priority in air traffic patterns, Behncke asserted.

Despite the Washington, D. C., mishap, the scheduled domestic airlines have maintained a high safety level this year. Only other fatal crash involving a regular airliner was the collision of a Navy fighter with an EAL DC-3 near Fort Dix, last July 30.

The Fort Dix mishap resulted in 12 passenger and three crew fatalities; the Washington, D. C., accident caused 51 passenger and 4 crew deaths. The total of 63 passenger deaths thus far in 1949 compares with 83 passenger deaths in four fatal accidents on the scheduled domestic airlines last year.



FIREBIRD AIR-TO-AIR MISSILE

Air Force released today first details of its first air-to-air missile, Ryan Aeronautical Co.'s XAAM-A-1 "Firebird." Only 10 ft. long and 6 in. in diameter, the Firebird can be fired singly, or several can be launched in multiples from a fast-moving jet fighter to seek out and destroy enemy aircraft. With a compact, but very complete radar navigation system, the Firebird is designed to "home" on its objective. The end product of a 2-year, $2-million project carried out by Ryan, the missile has been flight tested at Alamogordo, N. M. It is said to be particularly effective against piloted aircraft, because it is capable of maneuvers beyond human endurance. After launching, a booster rocket in missile's tail pushes it to maximum speed, then is jettisoned by an explosion charge—cutting Firebird overall length to 7½ ft. Remaining power for last phase of interception is supplied by rockets in main housing. The warhead, designed to explode when close enough to insure destruction of the enemy, automatically detonates if target is missed. Not scheduled for regular production, Firebird's primary mission will be to aid in development of better air-to-air missiles.

New Group to Study Agricultural Planes

A new research foundation, aimed at developing agricultural uses of the airplane, is expected to provide considerable impetus toward expansion of the agricultural aviation market.

The National Flying Farmers Foundation, Inc., organized last week at Kansas City, plans to set up committees to examine various types of research projects including aircraft, chemicals, application equipment, etc., and accept contributions for such research. Eventually the foundation may develop its own research facilities, but first projects will make use of existing research laboratories.

Charles Rose of Roseland, Ark., was elected president of the foundation. Other officers: K. Starr Chester, supervisor of Battelle Memorial Institute, Columbus, Ohio, board chairman; E. O. Moore, Dexter, N. Mex., vice-president; Dr. Lippert S. Ellis, dean of agriculture, University of Arkansas, secretary-treasurer; Dr. Henry G. Bennett, president, Oklahoma A & M College, vice-chairman of board; Herb Graham, Oklahoma A & M College, executive secretary.

Organization is fostered by the National Flying Farmers Assn., of which Rose is also president.

Issue New Rules for National Air Races

If Cleveland wants the 1950 National Air Races the management will have to show that local communities in the vicinity of the race course do not object, the NAA contest board ruled last week.

The ruling announced by Roger W. Kahn, chairman, was accompanied by a series of new requirements for closed course high speed racing, aimed at increasing the safety factor both for participants, and persons in the vicinity of the races.

New rulings provide:

- Multiple lap high speed pylon racing by jet aircraft shall not be permitted in the future.
- Altitudes for closed course races shall be increased from a 200 ft. to 500 ft. minimum and from 500 ft. to 1,000 ft. maximum.
- At least two emergency landing strips shall be provided for possible forced landings on the back stretch of the race course.
- Flight path around speed course and areas adjoining each pylon shall be well policed to prohibit large gatherings of people.
- Pylons 2 and 3 on the Cleveland course will be moved to reduce turning angles and to provide a more uniform course.
- Contestants who cut a pylon will be required to complete one extra lap for each pylon missed, and circling of pylons will not be permitted under new regulations.
- Only one race of cross country type which finishes at the National Air Races will be scheduled for any one day of the races.

The contest board also set up several new requirements for the pilots. These include:

- Minimum experience of 500 hr. solo including 50 hr. in last six months.
- Minimum of 10 hr. including 5 take-offs and landings in the plane they intend to race, or one of identical design (at least 3 hr. in the plane to be flown in race). Contestant must certify he has completed this requirement unless it has been witnessed by CAA, NAA or Professional Race Pilot Assn. representatives.
- Pilots must demonstrate ability to complete a slow roll to both the left and right, at race speed, at 5000 ft. or above, in plane to be flown in race, with no appreciable loss of altitude.
- Pilots must demonstrate ability to fly minimum of 10 laps of prescribed race course at high speed, to satisfaction of technical committee, before participating in any high speed pylon race.
- Pilots will be required to wear parachutes, crash helmets, approved safety belts and shoulder harnesses. Properly fitted anti-G suits and oxygen masks are recommended.
- Contestants will be required to have complete physical examination by an aero-medical surgeon on the day before they race and an additional physical checkup will be required of contestants by an aero-medical surgeon, after each day's pilots' meeting.

Other new regulations pertaining to race planes provided:

- All planes in closed course pylon racing will be tested for carbon monoxide content in qualifying trials.
- All planes must have radio receivers capable of receiving control tower instructions.
- Aircraft coloring and marking shall be subject to approval by local race contest committee.

Sterling vs. Dollar

(*McGraw-Hill World News*)

MEXICO CITY—Conflict between sterling area airlines and dollar area carriers over international air fares came into the open at last week's early sessions of the International Air Transport Assn. traffic conference to consider 1950 rates.

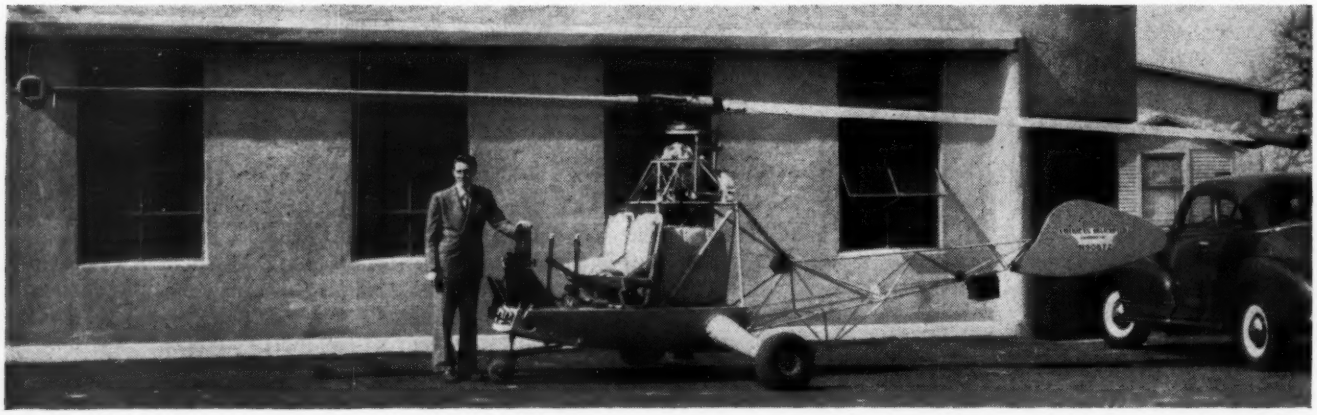
Nub of the question was a proposed 15 to 30 percent increase in fares in the sterling areas. Air France, KLM and other sterling lines announced flatly that they would vote against any increases, including a compromise 15 percent boost worked out by those anxious to achieve the usual conference record of unanimity.

New Runway Policy Clarified by CAA

New airport runway policy of CAA which has resulted in considerable controversy among airport managers, (AVIATION WEEK, Oct. 17 and Oct. 31) is aimed at increasing the "acceptance rate" of present and new airports, by providing for simultaneous use of two or more runways, according to a clarification last week.

Administrator Del Rentzel last week stated that CAA would participate in construction of an additional new runway or runways on Class II and larger airports, "provided that such runway or runways are necessary to expedite traffic and so located as to provide simultaneous use."

Rentzel added that CAA would participate in acquisition of land in excess of that required for current runway layout, when it was determined necessary for normal expected expansion.



PULSE JET COPTER

American Helicopter Co., Manhattan Beach, Calif., has received a USAF contract for flight testing new rotor and engine configurations to provide data for design of a military type pulse-jet helicopter. Photo shows the XA-5 (Top Sergeant) pulsejet copter used as flight test vehicle under the contract. Since last January over four hours of flight have been logged for the XA-5, Corwin Denny, president and chief engineer (shown with the aircraft) reports. The two-place Top Sergeant has a two-bladed 33-ft. diameter rotor, with two of the company's AJ-8.75 pulse jet engines fitted to the blade tips. The Top Sergeant weighs 900 lb. empty and 1400 lb. gross. Height overall is 98 in. and fuselage length of the copter is 244 in.

LETTERS

McDonnell Analysis

May I take the liberty of congratulating you and your magazine on the excellent article by Mr. Selig Altschul in the issue of Oct. 24 on McDonnell Aircraft.

The write-up on the company is far superior to the general run of stories of this kind. Mr. Altschul not only presented a clear picture of the current financial position of the company but, apparently, did a substantial amount of work reconstructing the financial history of the company.

Belmont Towbin
61 Broadway
New York, N. Y.

Races & Sanity

I can't resist commenting on Bevo Howard's letter outlining what he believes to be the advantages of the National Air Races.

Your editorial, "Dangerous Exhibitionism" was very well taken, and stated the case for sanity in the aviation industry as well as I've ever seen it done. It is vitally important to the aviation industry that such exhibitionism be done away with—not forever, possibly, but at least until we can convince the general public that aviation really is a serious, responsible industry, that airplanes are an acceptable means of transportation, not vehicles for an organized collection of death-defying antics.

If ever I have indulged in hero-worship I would say that Bevo Howard would be at the top of my list. I don't think I've ever known a finer guy, or such a superb pilot. I, too, get quite a thrill out of watching him perform. But by no stretch of my imagination have I ever been able to visualize his performances as being the sort of thing that would convince my wife that flying is a safe and sane thing. And, mind you, Bevo is at the top of my list; there are a lot of other pilots who do that sort of flying who are not nearly so good, who take more chances than Bevo (who is a perfectionist), and who get themselves knocked off in a blaze of flaming gore. I know too many non-flyers—and even flyers themselves, amateurs who are not quite sure of themselves, who get the shakes after seeing such exhibitions.

To say that the air races—or any such shows—contribute anything constructive to aviation is, in my opinion, so much malarkey. Trying to justify such stuff is like saying bullfights are necessary to the advancement of the science of animal husbandry. It's pure bunk. Bill Odom's death did aviation more harm than all the good that's been done aviation by every hair-raising air show since the invention of the airplane. The whole world was told that Odom—a highly-skilled pilot whose name was known to everyone—had torn himself and two other people to pieces in an airplane crash.

I talked with Bill about flying that Mustang in that race. I asked him why he would risk his neck in such schenanigans. He didn't need the money; he had just opened what held promise of being a highly profitable operation of his own at Teterboro Airport. Bill, at least, was honest about it. He admitted he was doing it for the thrill of it. There was nothing about this being some new way to test the aerodynamics of the Mustang. There was nothing about the engine manufacturers supposedly waiting with bated breath to find out something about their engines they didn't already know.

Those of us in aviation have a serious, sober obligation—convincing more and more people that our new way of travel makes sense, that the people in it really aren't the wild-eyed screwballs they've been made out. And, as a matter of fact, we do fairly well at that job about 362 days out of the year. Then, for three days—and for the whole world to see and hear via newspapers, magazines, radio and television—we make a strong bid to unsell a lot of people we'd almost had convinced.

I'm not saying the National Air Race people are deliberately, maliciously trying to hurt aviation. I think they're a little ahead of their time, if you want to compare their show with the Indianapolis auto races. I think we should wait until we're pretty sure we have the majority of people convinced that everyday aviation makes sense, before putting on whoop-and-holler exhibitions and races that scare hell out of them.

Max Karant
Asst. General Mgr. and Editorial Director
Aircraft Owners & Pilots Assn.
Washington, D. C.

The Air Races

I wish I could write part of your editorial page. I feel very strongly on the subject of the National Air Races.

When will the races return to their original aim? For the past four years we have seen a strong deviation from the original purpose, to promote new designs in aviation engines and aircraft. . . . In all the races since the war, the Thompson Trophy developed into a race to see which F-51 could fly faster. Of course, it was a test of individual pilot skill, but it proved nothing about the aircraft or engines. . . .

Nothing new will come from aviation if we simply pit obsolete World War II planes one against another. These are not planes which will be used by civilians and they have already been discarded by the military forces. The mere fact that certain refinements in design have been worked out adds nothing to their ultimate usefulness.

Let us get back to a competition wherein our inventive minds will be put to work to produce craft which will fly better than the other fellow's because one fellow thinks up a new idea to make his plane better. These will inevitably be reflected in better production planes for the public. The Goodyear Race is carrying out this program now in a small way. Let's see the Thompson and other races do the same.

Walter W. Ross
Ross Aviation Corp.
St. Louis, Mo.

Stall Warnings

The following domestic markets have advised us that they are granting a specific reduction in crash insurance when an aircraft is equipped with a Safe Flight Pre-Stall Indicator:

Employers Mutual Liability Insurance Co., Wausau, Wis.; Liberty Mutual Insurance Co., Boston, Mass.; Aviation Insurance Underwriters, Fort Worth, Tex.; National Retailers Mutual Insurance Co., Chicago, and American Mutual Liability Insurance Co., Boston, Mass.

We have not queried all underwriters as to whether they grant this specific reduction and also whether they take its presence into consideration in underwriting a risk.

Aero Insurance Underwriters and J. Robert Chapman's firm, Associated Aviation Underwriters, granted a specific rate reduction for the SFI. However, Associated dropped the credit shortly after Aero withdrew from the private aircraft underwriting market.

Mr. Chapman's "I'm from Missouri" attitude in his recent letter in Aviation Week June 20 may be very admirable in selecting underwriting risks, but it is not when dealing with the nation's No. 1 pilot killer. Last year stalls caused 52.3 percent of all fatal accidents.

Expert groups, such as the Non-Scheduled Flying Advisory Committee, AOPA, CAA and NAA, have set policies strongly recommending the SFI, while Mr. Chapman says that he is convinced that the Safe flight Pre-Stall Indicator would do nothing more than tell the pilot that he is going to crash and can't do anything about it. That certainly does not agree with the statements of pilots, in writing, who reported to Bill Strohmeir that the SFI prevented inadvertent stalls which otherwise would have resulted in accidents.

Leonard M. Greene, President
Safe Flight Instrument Corp.
White Plains, N. Y.

Titanine Clinic

We have received a great deal of favorable comment on the fine write-up of our Titanine Clinic. This, of course, acknowledges the fact that people read your articles and subscribe to, beg, borrow or steal Aviation Week to do it.

Lawrence Zygmunt
General Aircraft Supply Corp.
Detroit, Mich.

FINANCIAL

Plane Firms Revise Dividend Plans

Policy of putting payments on regular basis is making air stocks more attractive for conservative investors.

An increased flow of dividends is beginning to impart a sustained investment character to many individual aircraft companies.

In the past, the speculative aspects of aircraft manufacturing have been responsible for discouraging commitments by conservative investors seeking regular dividend payments. Aircraft equities have had a highly speculative flavor and appealed only to those who were in a position to assume risks to obtain substantial gains through sharp appreciation in market prices. Further, when dividend payments were made, up until recent periods, such disbursements were on a sporadic and uncertain basis.

A past tendency peculiar to the aircraft builders, even when operating at very profitable levels, was to defer dividend action until the year's final results were pretty well established. Frequently, this resulted in year-end surprise disbursements to stockholders. There has been a greater recognition, however, of the importance of cultivating good stockholder relations by regular, quarterly dividends; confining the surprises to extras from time to time.

▶**Now Paying Quarterly**—This major transition is evident in the current policy of Douglas Aircraft. Starting with its current fiscal year, Douglas has switched to paying regular quarterly dividends instead of making one lump disbursement at the close of its annual period.

Early this year, the company paid an extra of $2.75 per share with the regularly-established quarterly disbursement of $1.25. In addition to two subsequent quarterly payments, Douglas has again declared an extra of $1.50 per share. This brings total payments for its 1949 fiscal year thus far to $9.25 per share. More is yet to come as the company has promised to consider another disbursement when the final results for the year are known.

Another familiar trait of aircraft management in past years was to conserve the bulk of earnings by re-employing such funds in the business and withholding disbursements to stockholders.

For most aircraft companies, this argument is becoming less valid with the passing of time. The postwar reconversions should have been completed and normal working capital relationships properly arranged. There will always be a definite uncertainty on certain phases in the aircraft outlook just as there is in business generally. Hence, the bromides of the past are no longer effective in denying stockholders a tangible participation in available earnings.

▶**Grumman Record Good**—Grumman has regularly commanded a top investment rating among the aircraft builders because of its consistent earnings and dividends payments. During the entire 18 years of its existence, Grumman has earned a profit every year and made disbursements to stockholders annually. This is a unique record in the aircraft industry and would do credit to any business.

Further, the record shows that once Grumman raised its dividend rate, it was maintained at that level until again increased. The management, however, continues to follow the element of surprise in making semi-annual disbursements. In this instance, the background of continuous dividend payments has been most re-assuring to its stockholders, removing much uncertainty.

This year, Grumman has paid two $1.00 dividends, equalling the $2.00 per share paid during 1948. This exceeds the equivalent of $1.50 paid in 1947, $1.00 in 1946 and 75 cents each during the two previous years. The company's earnings this year are expected to exceed $3.00 per share, for a postwar high.

The recent action of Boeing in declaring another $1 per share dividend following a similar action earlier this year, was a considerable surprise to most observers.

For the nine months ended Sept. 30 the company reported earnings equivalent to only $1.64 per share. It is obvious, therefore, that the management expects that the results for the year to exceed the $2.00 per share in dividends authorized for 1949.

▶**Lockheed Policy**—Lockheed's dividend policy has been influenced by its erratic earnings record. Thus far during 1949 two separate dividends of $1.00 and 50 cents each have been paid. Expectations are for at least another 50 cents to be declared before the year is over, in view of anticipated 1949 earnings of around $3.50 to $4.00 per share. Lockheed paid regular quarterly dividends of 50 cents per share throughout 1943, 1944, 1945 and during the first half of 1946.

▶**United Aircraft's Record**—United Aircraft, due to its diversified aircraft manufacturing activities, formerly enjoyed a preferred place in the industry's standing among various investment trusts. The failure of earnings and dividends to be maintained at stable levels, however, has caused significant liquidation of the company's common stock by a number of funds. So far this year, a dividend of only $1.00 per share has been paid.

With current earnings running below 1948, considerable conjecture surrounds the amount of the year-end disbursement. Certainly, not more than another $1.00 per common share is anticipated with 50 cents more likely.

While consistently normal earnings are lacking for Curtiss-Wright, the company's strong financial condition and threat of stockholder pressures appear to point to a maintenance of recent dividend rates. Here again, an aircraft company has switched to quarterly payments in favor of past surprise sporadic disbursements. Holders of the company's Class "A" stock, in recent years, have been receiving total dividends amounting to $2 per share annually. During 1949 a quarterly rate of 25 cents per share has been declared for the common stock.

In view of excess capitalization in relation to its existing volume of business, additional attempts may be made to reduce the number of outstanding shares through further stock tender offers.

▶**Tokens Made**—Companies making token dividend disbursements during 1949 include Beech, Cessna, North American Aviation, Fairchild Engine and Ryan.

Those units refraining from paying any dividends and unlikely to do so this year include Consolidated Vultee, Glenn L. Martin Co. and Republic.

An examination of general market trends discloses the importance of a regular dividend policy in order to establish wider acceptance in recognized investment circles. The aircraft industry is competing with other broad industrial segments for favor and financial support.

Considerable investment buying is generated from sources concerned with obtaining a consistent income. There are large segments of the aircraft industry which have demonstrated the ability of developing substantial earning power and whose outlook is encouraging over the near future. The regularity of dividend payments, however, must be maintained to make aircraft securities desirable for placement in investment trusts, pension funds and other fiduciary accounts. —**Selig Altschul**

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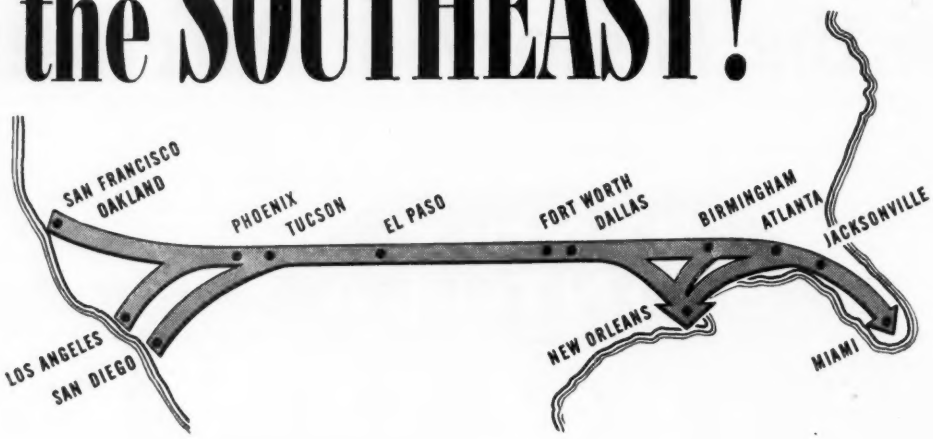

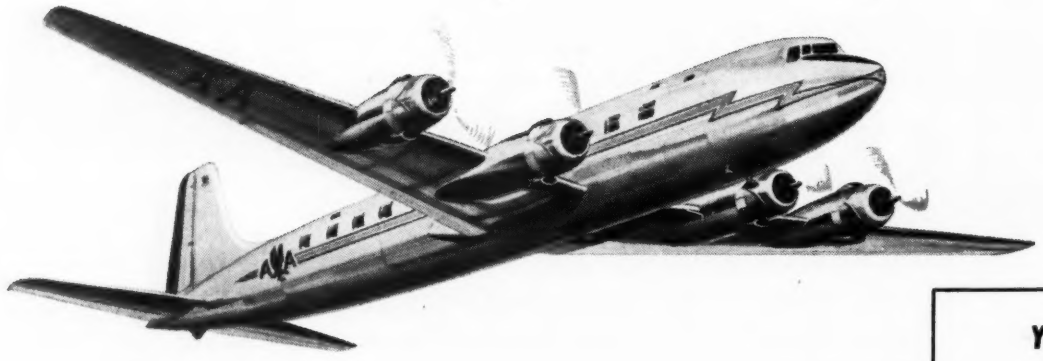

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Air Brakes: Standard Fighter Accessory

Variety of forms is available for quick control of air speed to allow more flexible operational procedures.

By Robert McLarren

Low drag and high power of the modern jet fighter permit high accelerations to be attained in flight. Not only are these accelerations a potential danger to the aircraft's structure but they have important tactical drawbacks.

For example, upon overtaking another plane (an enemy craft under attack or a plane resuming a friendly formation), pilot must have some means of quickly slowing his aircraft. During combat maneuvers, it is often necessary to slow the airplane to avoid exceeding its structural limitations. Such considerations have resulted in the addition of a new control to high-speed fighters —an air brake.

This is an outgrowth of the familiar dive brake, the newer term "air brake" encompassing both diving and level flight deceleration. Basic function of an air brake is to provide a drag increment over the basic drag of the plane, thereby creating a negative acceleration of the craft and reducing its speed.

► **Background**—The original air braking problem was created by dive bombing tactics, pioneered by the U. S. Navy and Marine Corps in the late '20s and early '30s. The steep dive required for bombing accuracy permitted the plane to build up very high speed at a low altitude, necessitating a high-g pullout and creating high stresses on the craft and pilot.

In 1934 the Navy Bureau of Aeronautics expressed interest in some method of limiting diving speed but this consideration had been anticipated in 1932 by the German glider designers and sport pilots, who applied small, controllable panels to the wing to slow the glider during landing approach.

► **German Work**—Design of these spoiler panels was given serious study by researchers at Deutsches Forschungsinstitut fur Segelflug (D.F.S.), near Darmstadt, where much literature was compiled on the subject. The data were used in '35 in the design of the first spoiler-panel dive brakes, mounted on the Junkers Ju-87B "Stuka" dive-bomber completed the following year.

These were simply rectangular spoilers mounted flush on the front spar just outboard of the landing gear. Movement of a mechanical control in the cockpit rotated them through 90 deg., providing effective deceleration to the Stuka.

They were retained on later Stuka models used in the attacks on Poland, France, England and North Africa. A similar installation was used on the famed Ju-88, one of the most effective Luftwaffe weapons in service in various models throughout the war.

► **U. S. Applications**—Credit for the first U. S. dive brake and the first double split dive flap is due ingenious John K. Northrop. He incorporated an additional split flap panel on the upper surface of the Northrop XBT-1 Navy dive bomber in 1935. Both flap panels were perforated and strengthened for high speed operation.

This installation remained unchanged throughout the development of the plane into the XBT-2, SBD-1 and subsequent models to SBD-6, the Douglas "Dauntless" of Pacific Theater fame.

A third air brake type, the "lattice" panel, was developed from early D.F.S. data into the system used on the Vultee "Vengeance" (A-31, A-35) dive bomber, originally developed in 1940 for the British but subsequently used by the U. S. Air Force. Similar installations were made on the North American A-36 light dive bomber, Northrop F-61C, McDonnell FH-1 jet fighter, and others.

► **On Fuselage**—First fuselage location of an air brake was on the Lockheed F-80A jet fighter, which features two small panels mounted under the fuselage near the wing leading edge. Another installation, using only one panel, is used on the Republic F-84 jet. First location of air brake panels on the aft fuselage is on the Douglas AD "Sky Raider" dive bomber, and most recent installation in this location is the North American F-86, McDonnell F-88 and Douglas D-558 Navy research planes.

Thus, over the period of the last 15 years a wide variety of types, sizes and locations have been developed and proved in actual service, much of it in combat. This accumulation of service and test data, augmented by extensive scientific research, now permits the rational design of such equipment and an appraisal of the respective merits of various arrangements.

► **Slot-Lip Aileron Studied**—Indicated terminal diving speed of an airplane is a function of drag and wing loading:

$$C_d = \frac{391\ (W/S)}{(\delta^{\frac{1}{2}}\ V\text{mph.})^2}$$

where δ is the density ratio of altitude to sea level.

This relationship is plotted in Fig. 1 for a variety of wing loadings and drag coefficients. This chart provides an indication of the amount of drag required to maintain a predetermined diving speed. By subtracting the known drag of the airplane design from this value, the amount of drag that the air brake must provide will be determined.

Next step is to determine the amount of drag various air brake forms can provide. One of the earliest wind tunnel investigations in this country, undertaken by the NACA at the request of BuAer, examined the possibilities of the slot-lip aileron as an air brake control.[1] This is a conventional slotted aileron in which a movable lip is mounted just forward of the gap. The profile was a standard NACA 23012 section with the aileron chord 0.2566 wing chord and the slot chord 0.10 wing chord.

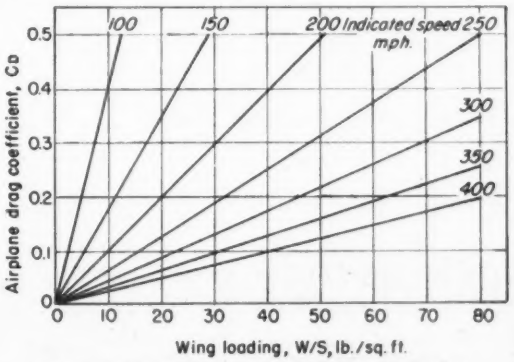


Fig. 1 Indicated terminal velocities for various wing loadings and drag coefficients (Ref. 1)

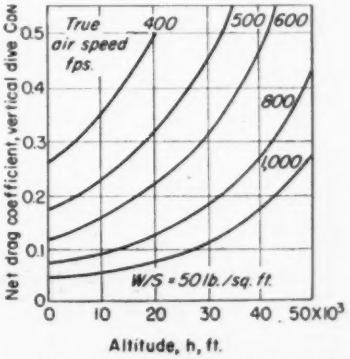


Fig. 2 Drag coefficient for no acceleration in vertical drive (Ref. 8)

Measurements were taken with aileron motion from zero to 50 deg. and lip motion from zero to 60 deg. Maximum deflection of both aileron and lip produced a section profile drag coefficient of 0.4, or an increment of 0.38 over the combination at zero deflection. While this value is too low for design usefulness, this study indicated the potentialities of the design.

▶**Split Flaps**—Next step was an investigation of split flaps as air brakes on a rectangular wing, with particular reference to perforated flap surfaces.[2] This extensive test series included examinations of a double split trailing edge arrangement at various locations along the span and chord, and single split flap panels at various locations along the lower side of the wing chord, including the effect of gaps between the wing and the flap.

Data indicated that buffeting could be reduced substantially by perforations which remove about 30 percent of the original flap area, reducing the drag coefficient by only about 15 percent.

▶**On Tapered Wing**—These tests were continued on a tapered wing, results indicating approximately the same effects on the aerodynamic and wake characteristics of this airfoil as on a comparable rectangular airfoil.[3] The test series, however, considered the use of split flaps as brakes for the deceleration of a fighter aircraft in substantially level flight. This use introduces the necessity for the brakes to provide sufficient increase in lift coefficient during their operation to maintain level flight as the speed is reduced.

This requires a sequence operation of the upper and lower flap panels, as follows: both flaps deflect to 30 deg. within 1 sec., the lower-surface flap then deflecting to 60 deg. while the upper flap remains stationary.

Calculations carried out for a typical propeller-driven fighter indicated that this arrangement should reduce the speed from 300 to 176 mph. in about 8 sec. with a negligible change in angle of attack and a change in wing pitching-moment coefficient of only −0.03.

▶**Quick Opening Important**—Several important parameters in the design of air brakes were developed in a study of available data and indicated the practicability of trailing edge, split flap type air brakes which caused a minimum change in angle of attack and pitching-moment coefficient.[4] This study signified that the effects of increased altitude are to increase the maximum acceleration and decrease the indicated-velocity reduction.

Calculations showed that the drag coefficient increased rapidly the first second, then more slowly to a maximum of 0.115 after 4½ sec. required for full deflection of the flaps. These data evidenced the importance of quick-opening characteristics of air brakes.

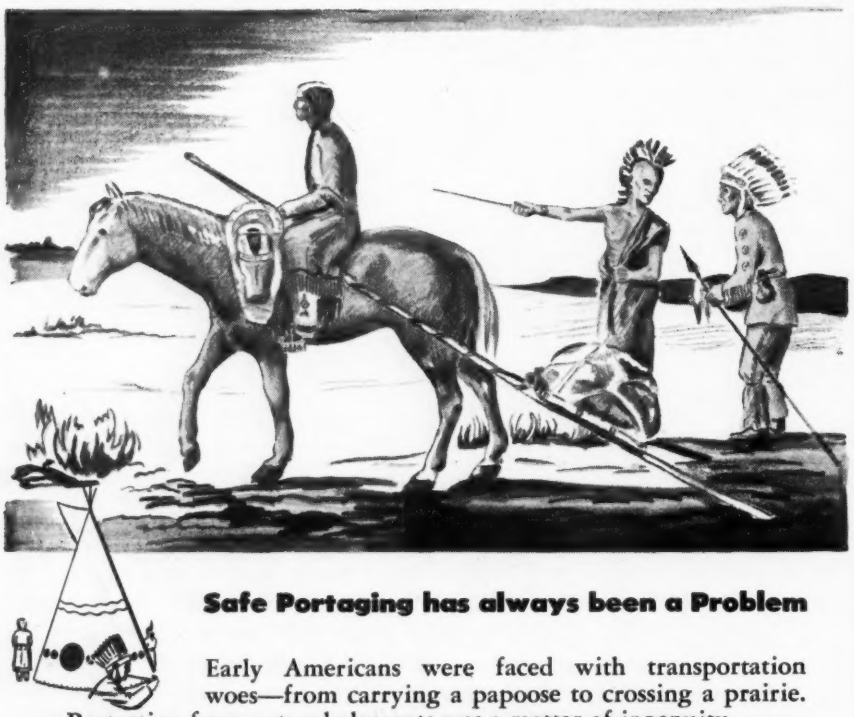
In a continuation of the investigation on the NACA 23012 airfoil with perforated flaps, a wind-tunnel program was undertaken to determine effects of various perforation shapes and sizes and to obtain information on flap loads.[5]

These data showed a relative unimportance of the shape of perforation on the flap loads and provided quantitative information supporting the conclusion that flap loads varied inversely with the amount of perforation used.

▶**"Compressibility Dive Flap"**—Rapid change in altitude resulting from a steep dive at high speed means that the true speed would have to be reduced to keep from exceeding the allowable indicated speed.

This phenomenon produced severe compressibility effects on the wartime Lockheed P-38 Lightning twin-engine fighter at speeds of less than 400 mph. in dive pullouts.

An extensive investigation at the NACA Ames Aeronautical Laboratory produced a "compressibility dive flap" located on the underside of the wing about ⅓ chord back from the leading



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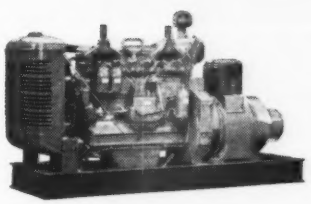

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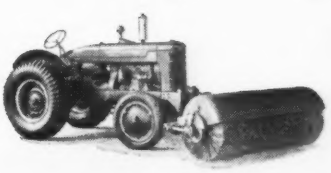

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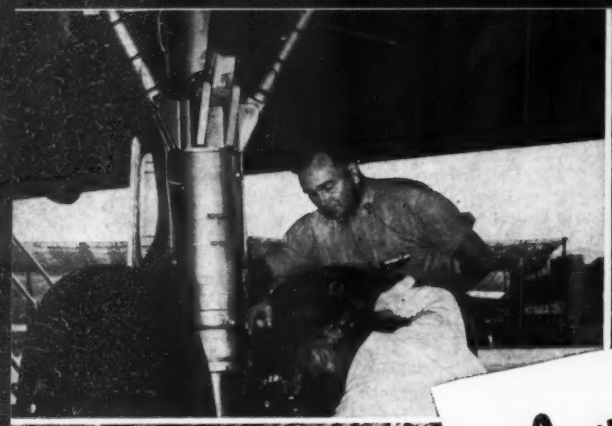

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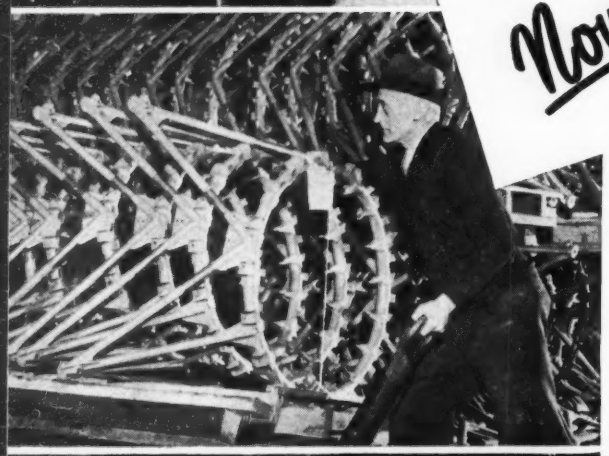

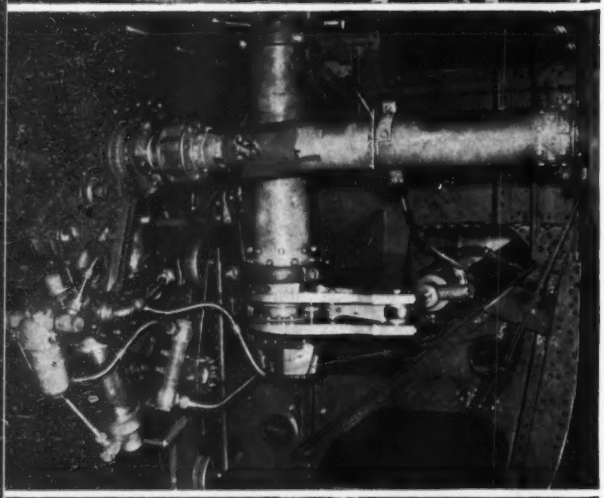

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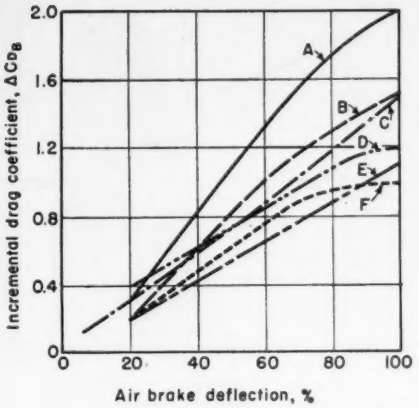


Fig. 3 Variation of air brake drag coefficient with percent full brake deflection (Ref.8)

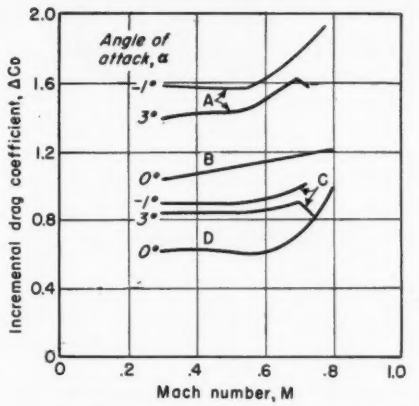


Fig. 4 Effect of mach number on incremental drag coefficient due to air brakes (Ref.8)

edge, affording positive increments in pitching moment that effected satisfactory recovery of the airplane from high-speed dives.[6]

These flaps were installed on the production Lockheed P-38J fighter and permitted the airplane to recover from 15,000-ft. dives at speeds as high as 531 mph. at 20,000 ft.[7]

▶ **Problem Simpler on Jets**—Fig. 2 illustrates the drag coefficient required for a constant true airspeed to be maintained in a vertical dive.

This graph shows that the faster the plane's diving speed, the lower the net drag coefficient required to maintain the dive, indicating that the air brake problem is actually much simpler on high-speed jet fighters than on earlier propeller-driven models.

Another important fact signified by this figure is that the higher the altitude, the greater the net drag coefficient must be to maintain a constant true airspeed.[8]

▶ **Effectiveness with Deflection**—Fig. 3 presents the relative effectiveness of a variety of typical air brake types as a function of their deflection.

Type A is an upper surface spoiler located 0.20 chord.

Type B is a similar type, but located on the lower surface of the wing.

Type C is an upper surface spoiler located at 0.75 chord.

Type D is an upper surface spoiler located at 0.63 chord.

Type E is an aft-fuselage panel, such as is used on the North American F-86 and McDonnell XF-88.

Type F represents double split trailing edge flaps located at 0.80 chord.

This figure indicates that a spoiler located on the upper surface of the wing 20 percent chord aft of the leading edge is a tremendously effective air brake.

Comparing these data with Figs. 1 and 2 shows that such an air brake is a powerful and effective device in maintaining a constant airspeed in a vertical dive or in slowing the airplane down in level flight.

Other types are less effective, and poorest from the standpoint of drag effectiveness is the aft fuselage air brake panel used on the F-86 and F-88.

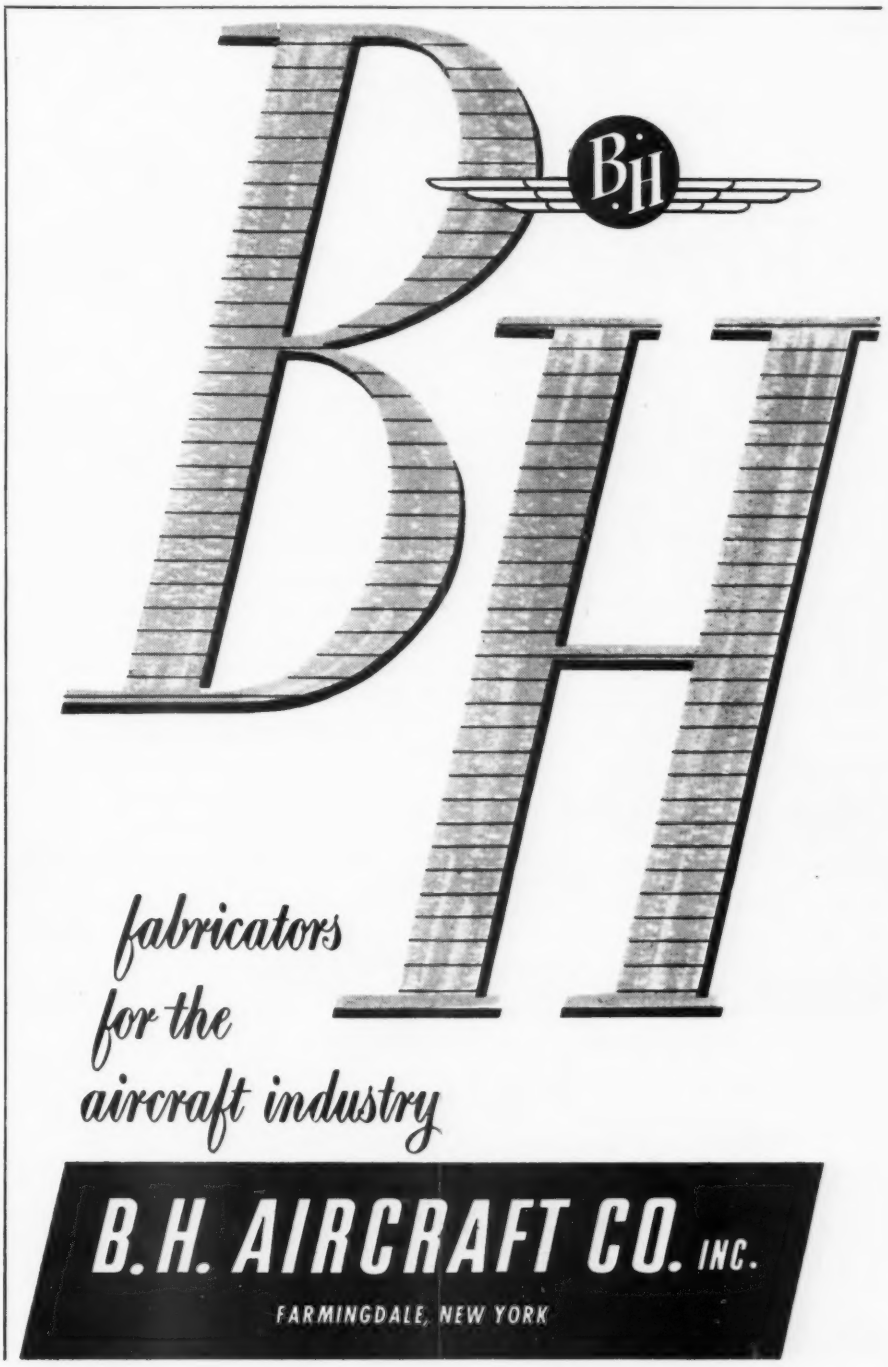
However, as was shown earlier, the ordinary high speed of these two aircraft render unnecessary high effectiveness in air brake design.

▶ **Effectiveness with Speed**—An important characteristic of air brakes is shown in Fig. 4, which indicates the relative effectiveness of various designs at varying speeds.

In this graph, Type A is a double split trailing edge flap located at 0.63 chord.

Type B is the aft fuselage panel installation.

Type C is a double split trailing edge flap located at about $\frac{1}{8}$th chord.



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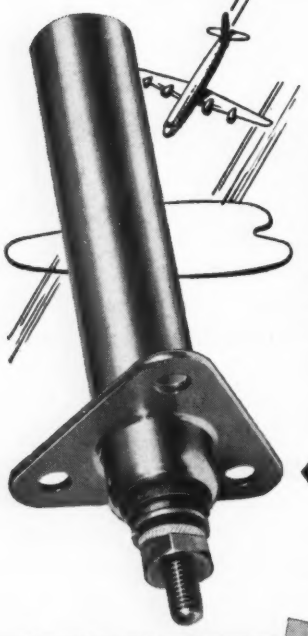

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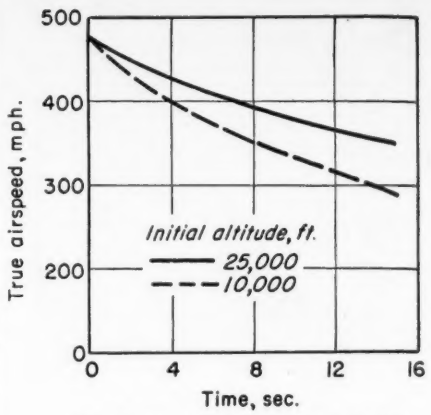

Fig. 5 Variation of airspeed with time for airplane with air brakes (Ref. 8)

Type D is the installation used on the Lockheed F-80 Shooting Star.

This figure shows that the Type B aft fuselage air brake provides a smooth variation of drag coefficient increment with Mach number, whereas all of the others show a variation of this parameter with Mach number.

Greatest variation is that of the underfuselage installation of the F-80, which provides an increasing effectiveness with increasing Mach number, an ideal characteristic.

An example of the simple calculations required for estimation of speed variation in level flight is given below. The following is for a fighter airplane with a wing loading of 50 psf. flying at 25,000 ft.

$$K = C_{dn}\frac{\rho}{2}\frac{g}{W/S} = \text{deceleration factor}$$

If it is assumed that $C_{dn} = 0.114$, then

$$K = (0.114)\left(\frac{0.001066}{2}\right)\left(\frac{32.2}{50}\right)$$
$$= 0.0391 \times 10^{-3} \text{ per ft.}$$

Since

$$V = \frac{1}{Kt + (1/V_o)}$$

Then

$$V = \frac{25{,}600}{t + 36.6}$$

At 10,000 ft.

$$K = 0.0644 \times 10^{-3} \text{ per ft.}$$

Therefore,

$$V = \frac{15{,}500}{t + 22.2}$$

These relationships as a function of time are shown in Fig. 5, which illustrates the profound effect of altitude on the time required for a given speed reduction. Time required at 10,000 ft. is 40 percent less than that required at 25,000 ft.

(Continued on page 28)

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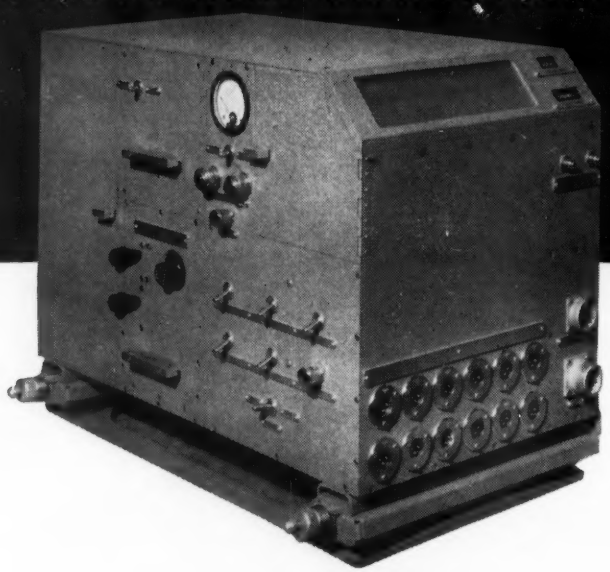

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Although the use of air brakes is already widespread, being required installations on jet fighter planes, there appears little question that this device will grow rapidly in importance as speeds increase, as traffic control problems grow more acute and as operating altitudes increase.

Deceptively small in appearance, it appears destined to become a vital control on future high-speed aircraft.

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Accurate Measure For Stratosphere Weather

A new instrument carried in a plastic balloon, which permits accurate measurement of temperatures and humidities at 99,000 ft. altitudes, has been developed under Navy contract by the University of Chicago and the aeronautical division of General Mills, Inc., Minneapolis, Minn. This altitude is about twice that at which accurate humidity measurements previously could be obtained.

University of Chicago scientists believe the new instrument will be particularly helpful to aeronautical engineers engaged in designing high-altitude aircraft. It was developed because devices formerly used (radiosondes) were not completely reliable in the low vapor concentrations and cold temperatures of the stratosphere.

The new device, employing the dew-point hygrometry technique for measuring humidity, transmits information to ground receivers via an electronic signalling system.

New Power Conversion Means Developed

Electronic systems replace moving parts in compact airborne equipment for achieving higher accuracy.

By Austin N. Stanton*

Avionics is supplying a straightforward answer to one of the most perplexing problems confronting the aircraft design engineer. This difficulty is the procurement of trouble-free and accurate equipment for converting power from whatever system chosen as a primary power source to that form required by the many available avionic devices, such as autopilots, bombsights, computers, gyros, clock systems, synchronous motors, radios, radars, etc.

Regardless of the conversion required —from 28v. d.c. to a.c., a.c. to d.c., d.c. to d.c., single phase to polyphase, or from one frequency to another, and regardless of the frequency accuracy required, the job can be accomplished through recent advances in this field.

Previously, these conversions have been accomplished with generators driven by motors utilizing various controls. Both the rotating equipment and the controls were subject to many ills, as service departments are well aware.

Through new techniques evolved, moving parts are eliminated, precise control is attained, and many new fields of power conversion have been opened.

Present developments have produced these avionic power conversion units:

- Electronic inverters (d.c. to a.c.)
- Static converters (a.c. to d.c.)
- Transformers (d.c. to d.c.)
- Voltage regulators (a.c. to a.c.)
- Frequency converters (a.c. to a.c.)
- Phase adapters (single to polyphase).
- Voltage regulator-phase adapter (single to polyphase).

► **Units Described**—An electronic inverter may be considered as made up of a single phase inverter, frequency generator, voltage control, and phase adapter.

The single phase inverter may be a somewhat simple adaptation of the classical parallel inverter, it may be self-fired by proper cross plate-to-grid networks, or it may externally driven, depending on the need for frequency accuracy.

The frequency generator may be of one of several types, such as tuned circuit, RC circuit or tuning fork, depending on the degree of accuracy desired. Variable frequency may be provided in several ways.

The voltage control may be of the feedback or the bridge type acting electrically through saturable reactors to control the output voltages to the desired degree of stability. In special cases output voltage may automatically be varied in accordance with peculiar load requirements, as constant current, voltage decreasing with increasing load, etc.

A phase adapter section may be used across the output where all or part of the output is required as three phase or two phase power. Conventional LC "phase splitting" circuits may be employed where load changes are relatively small. However, where large variations of output load are encountered, electronic controls may be added to vary the constants of various components to compensate for these load changes.

Where it is desired to convert one frequency to another, as from variable 320-1000 to constant 400 cps., a rectifier section may be used ahead of the inverter section to provide the needed d.c. for inverter operation. When properly filtered, very little of the input frequency appears as modulation of the output frequency.

► **Components combined**—To produce a unit of the desired power rating it is sufficient to choose the proper group of components, ensure that each has the required power handling capabilities and then design a suitable chassis to accommodate the various parts.

These components may be assembled in various combinations to produce the power conversion units previously listed. The accompanying tabulation shows the most important of these combinations.

To show how this is accomplished, typical applications are discussed here. Specifications are set up, components selected, and block diagrams giving the relation of components and power conversions effected are shown. Descriptions of the various components are given as they are incorporated in the unit.

► **Electronic Inverter**—Let us consider an electronic inverter (Fig. 1) having these specifications: Input 25 to 29.5v. d.c.; output 400 cps. ±.1 percent, three phase delta connected 115v.±.2 percent, 100va.

These specifications may be fulfilled by the use of a single phase inverter, frequency generator, voltage regulator and phase adapter with voltage regulation.

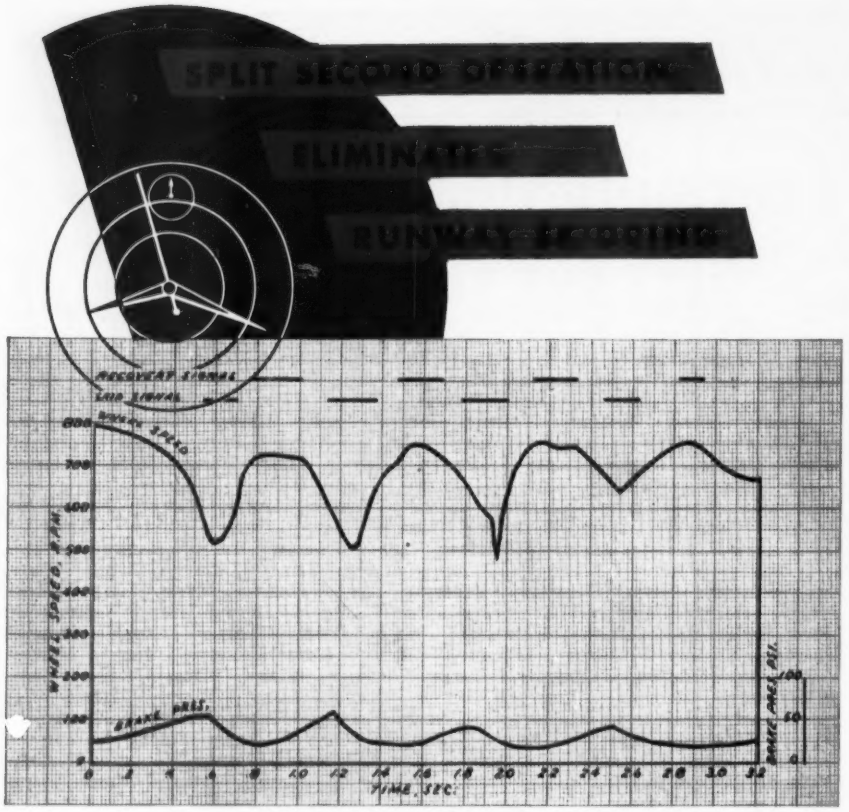
The frequency generator consists of a miniature tuning fork, much smaller than commercially available units, to reduce thermal capacity and space requirements, together with appropriate driving coils, pickup coils, driver tube, amplitude control, and an appropriate push-pull wave shaping circuit to prepare the fork output voltage for proper drive of the grids of the inverter thyratrons.

Where extreme temperature variations are to be encountered, —75 C. to 80 C., the fork, frame, driving coils,

Combinations For Power Conversions

Unit	Components: Inverter, Single Phase	Generator, Frequency	Regulator, Voltage	Adapter, Phase	Rectifier
Inverter, electronic (precision)	X	X	X	X	
Inverter, electronic (simple)	X	X			
Converter, static			X		X
Transformer, d.c.	X		X		X
Changer, frequency	X	X	X	X	X
Adapter, phase (LC)				X	
Adapter, phase (electronic)			X	X	
Regulator, voltage			X		
Regulator, voltage & phase adapter			X	X	

* President, Varo Mfg. Co., Inc., Garland, Texas.



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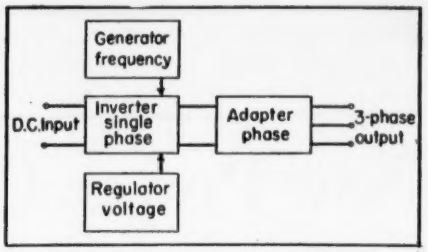


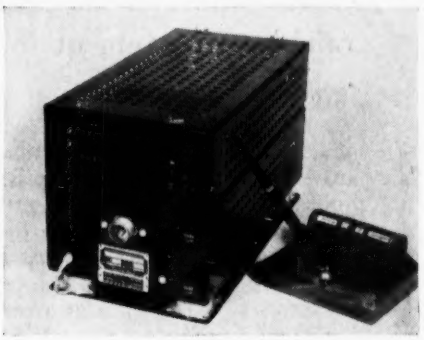


Fig. 1. Three-phase electronic inverter. Top is block diagram. Bottom, complete unit.

pickup coils and a tiny thermostat are hermetically sealed in an oven. The entire oven including terminals, insulation and mounting has a diameter of only $1\frac{1}{8}$ in. and is $2\frac{3}{8}$ in. long.

► **Single Phase Inverter Section**—In this example the single phase inverter section (Fig. 2) consists of a transformer having a center fed primary, whose outside ends are alternately connected to ground by thyratron tubes. Xenon-filled tubes are used when low ambient temperatures are expected.

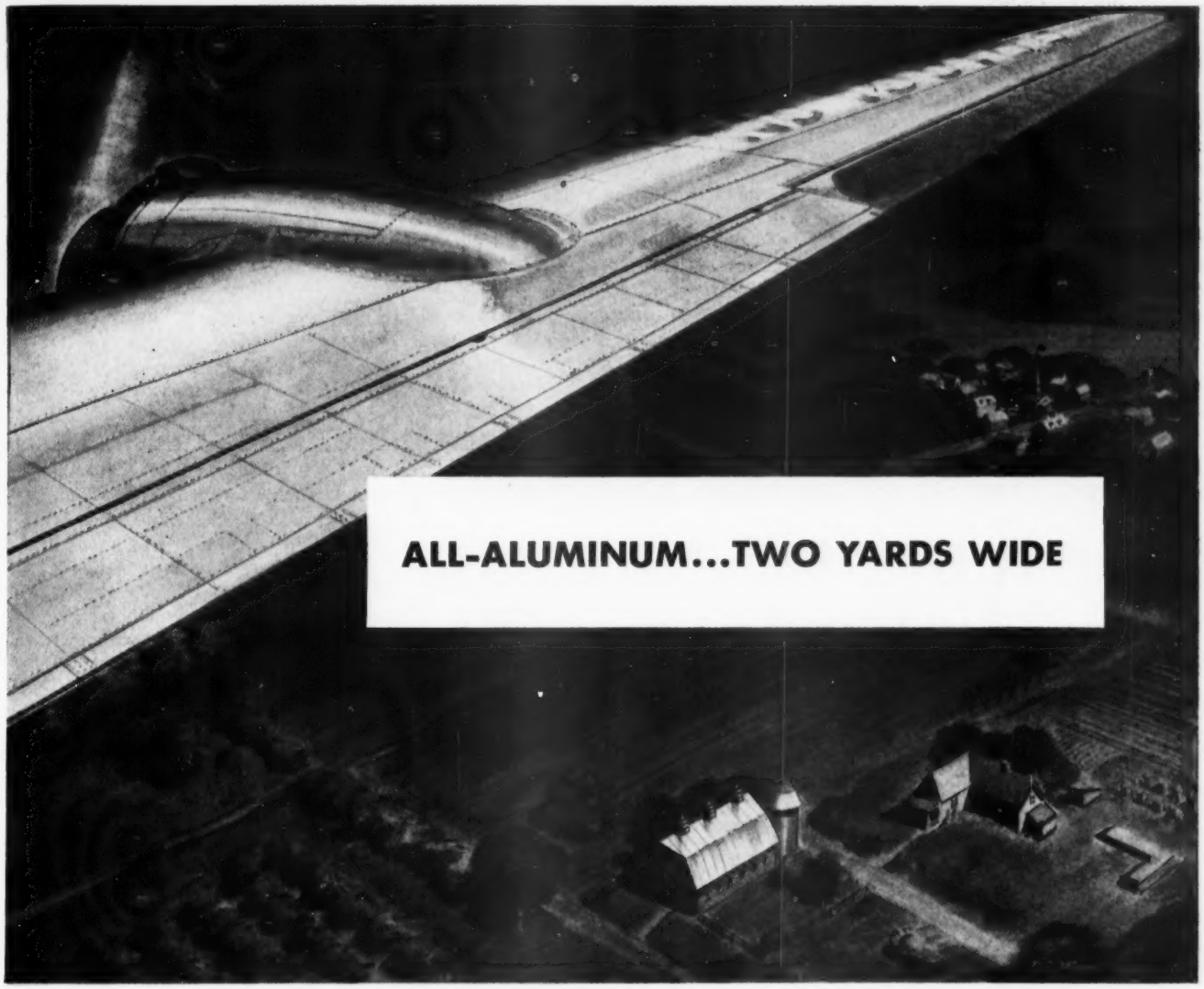
Across the primary of the transformer, and across the tube anodes, a commutating condenser is connected, which, when the "off" tube fires, drives the "on" tube anode voltage negative, thereby terminating its conduction. It quickly recovers, however, and is ready to fire when the next positive grid impulse arrives.

A secondary winding on the transformer delivers the useful single phase output current to the output terminals, usually through an RF filter section, to avoid interference with nearby or connected radios, radars, etc.

To obtain required latitude of voltage variation in the transformer primary, the d.c. is brought from the rectifier section to the primary center tap through a specially designed reactor.

The single phase output voltage is determined by the voltage control section by rectifying a small part of its output current and comparing the d.c. potential obtained to that across a voltage regulator tube.

The voltage difference, amplified, then controls the current through a saturation winding of the output transformer, or by other similar means. In this way, the impedance of the load is complemented, so that the total load on



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the transformer secondary appears to be a constant. Thus, constant output voltage and wave form are achieved.

Since our specifications require three phase delta connected output, we may employ a simple phase adapter consisting of a reactance and a capacitance in series connected across the single phase output. At some certain load, for properly chosen components, the voltage appearing at their common connection bears a true three phase relation to that appearing on the two single phase terminals.

At other loads, the voltages appearing across each of these two components are restored by the same means employed to control the single phase output voltage as described above. The third terminal is, of course, brought out through the RF filter as is the single phase. Excellent wave form in the second and third phases is obtained by this system.

In cases where less accurate control of phase balance is required, simpler systems are available which give excellent voltage balance over limited ranges of load. A further sacrifice must be made, however, to achieve this saving, because certain harmonic distortions are encountered in the added phases. In practice, however, these distortions can often be compensated by individual adjustment of the phase voltage.

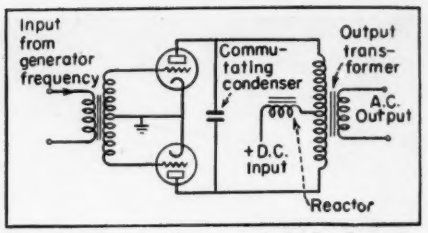

Fig. 2. Circuit diagram of single-phase inverter section.

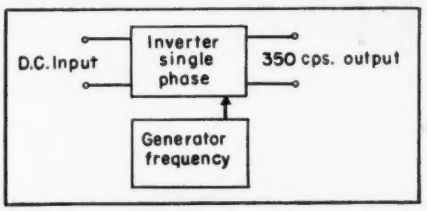

Fig. 3. Block diagram of simple single-phase electronic inverter.

► **What Accomplished**—By proper selection of parts we have been able to accomplish inversion, frequency stabilization, voltage regulation, changing from single to three phase, and waveform improvement. Even the effects of transients in the input voltage are greatly minimized. All this has been accomplished electronically without the aid of a single moving or rotating part, bearing, brush, slip ring, commutator, governor, or carbon pile regulator.

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Extremely well-controlled frequency opens an entirely new concept of reference accuracy. Computers, stabilizers, rate gyros, etc., may be designed using this frequency as their basic standard, achieving accuracies far beyond those based on present voltage standards.

► **Simple Inverter**—Let us consider another example, a simple and inexpensive inverter (Fig. 3), at the opposite end of the scale of design, where premium is placed on reduction of size and weight, not on frequency stability. This would be suitable, in many cases, for guided missiles. Suppose we impose the following specifications: Input 28v. d.c. ±10 percent; output 28v. ±10 percent, single phase, 350 cps. ±2 percent, 100va.

In this case, the frequency generator section might provide sufficient frequency stability if it consisted of a simple 350 cps. vacuum tube oscillator, driving the inverter thyratron grids through a push-pull transformer. The oscillator circuit might include a very

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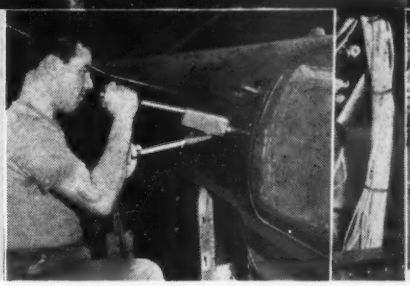

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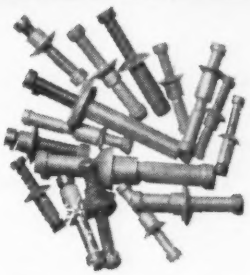

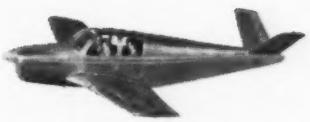

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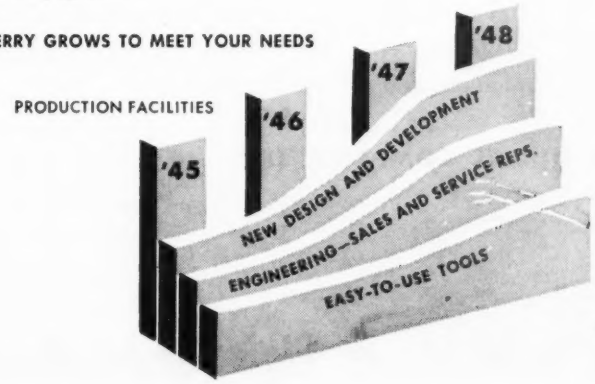

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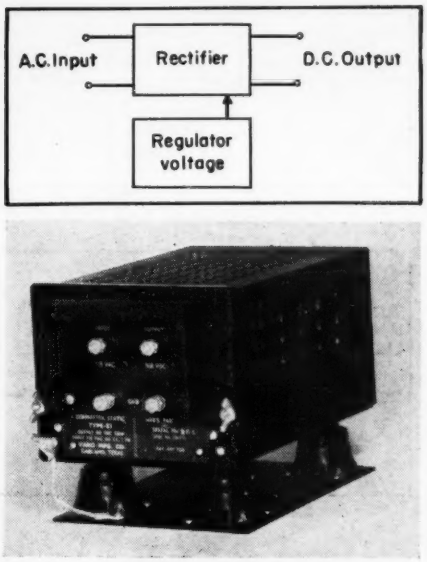

Fig. 4. Static converter. Top shows block diagram. Bottom is unit as constructed.

small iron core reactor, a capacitor, and a miniature tube.

The inverter section would consist of the same elements as in the previous example, except that, since the anode voltage is much lower, much lower impedances must be used, and a larger commutating condenser. The tubes would be of a new type specially designed, but currently available, having small size, high current rating, indirectly heated cathode, and a 14v. heater. They may be heated in 25 sec. by connecting directly across the 28v. line for that period, then connecting the two in series.

Since single phase only is required in the output, no phase adapter is required. Because output voltage need be held only to 10 percent, no electronic voltage control is required. This inverter would take the place of present small unregulated instrument inverters, but would offer these advantages—no moving parts, better frequency and voltage stability, simplicity, and serviceability.

► **Static Converter**—This is an avionic improvement of the rotary converter. By combining a rectifier section and a voltage regulator section, a unit is obtained which converts a.c. to regulated d.c. An example of this is shown in Fig. 4. Specifications are: Input 115v. ±10 percent, 380-420 cps.; output 0-400 ma., 300v. d.c. ±1 percent.

In this case a saturable transformer is used, the secondary feeding a thyratron rectifier. The voltage regulator circuit supplies saturation current to maintain constant output voltage. Advantages of this system include substantial weight- and space-savings.

The static converter may be combined with the simple inverter previously described, to form a d.c. transformer (Fig. 5). Let us choose characteristics as follows: Input 28v. d.c. ±10 percent; output 300v. d.c. ±10 percent, 0 to 200ma.

Since the intermediate frequency a.c. generated by the single phase may be of practically any frequency, and since the output voltage is to be regulated, a simple self-driven inverter may be used. No separate frequency generator will be required, merely a cross plate-to-grid network.

The rectifier-voltage regulator section will comprise the same components as the static converter above, or the regulator may take its control voltage from the d.c. output voltage and produce regulation by saturating the inverter transformer.

This unit is designed to take the place of vibrator power supplies and dynamotors. It has none of the current limitations of the vibrator systems, and none of the moving parts of the dynamotor. Of course, voltages may be either increased or decreased by this method.

► **Frequency Changer**—Let us consider a frequency changer whose specifications are: Input 320 to 1000 cps., single phase, 105 to 125v. a.c.; output 400 cps. ±.01 percent, three phase, delta connected, 115v.±1 percent. These requirements are fulfilled by use of a rectifier, frequency generator, single phase inverter, voltage control, and phase adapter. Fig. 6 shows these components

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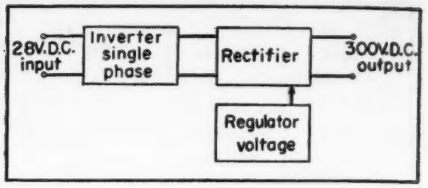
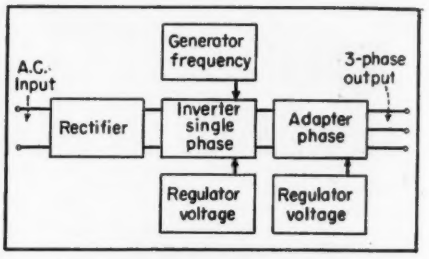


Fig. 5. Block diagram of d.c. transformer.



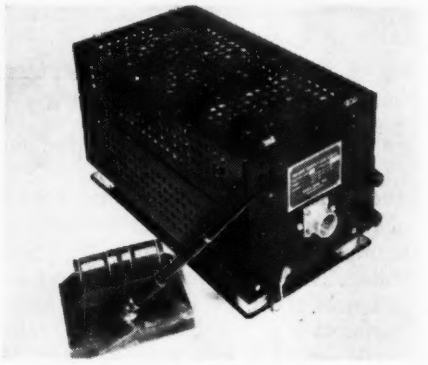


Fig. 6. Frequency changer. Block diagram is at top, complete unit at bottom.

assembled in a block diagram.

The rectifier normally consists of a full wave input transformer, two half wave gas rectifiers, usually thyratrons, and proper filter components. In some cases the d.c. output voltage is stabilized by phase control circuits which vary the relative firing phase of the rectifier grids. It is desirable, because of the normal 10 to 15v. drop in xenon-filled thyratrons, the relatively larger physical size of high current thyratrons, and the relatively larger heater losses of high current tubes, to use as low a current as possible through these rectifier tubes.

This, of course, requires the use of d.c. potentials as high as the available tubes will handle safely. No input transformer is required where the available a.c. voltages are reasonably high. Single phase or balanced Y-connected three phase input requires half wave rectification in this case. Delta connected sources normally have one phase grounded and therefore require an input transformer.

Frequency generator, single phase inverter, voltage regulator, and phase adapter sections are identical to those in the precision inverter described in the first example. Here the advantages of using standard components becomes quite apparent.

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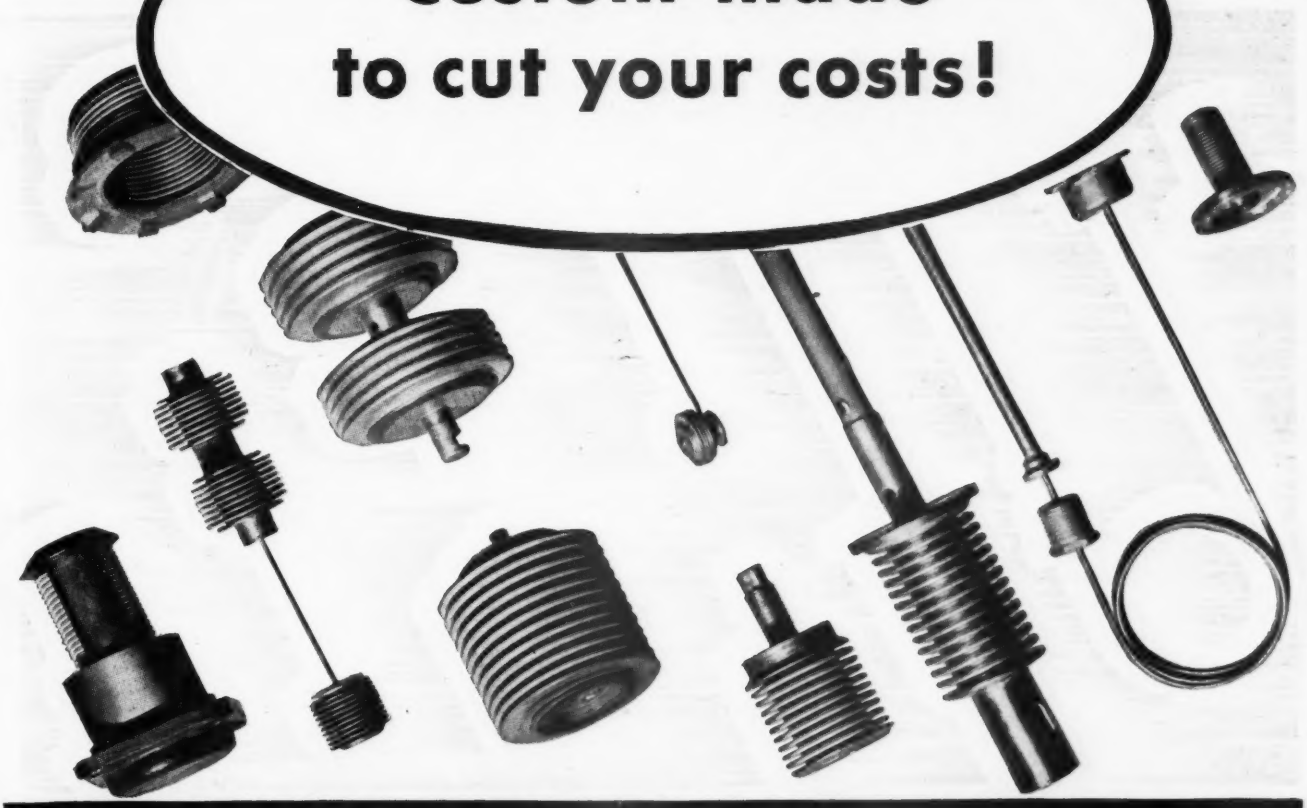

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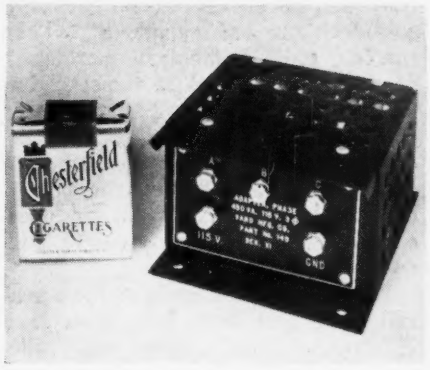

Fig. 7. Static phase adapter.

rect a part of the variable frequency output of rotary inverters for instrument use, or they may be of sufficient power handling capacity to correct the frequency and voltage of the entire power output of a direct connected alternator.

Where several alternators are used, as on multi-engine aircraft, each alternator may supply a separate frequency changer. Output of the several frequency changers may be connected to the same distribution busses, by driving them from the same frequency generator. This provides a unique answer to problems of speed control, large total power, small size of units and the problem of carrying emergency spare equipment without encountering excessive weight limits.

Considerable savings in cost are envisioned with this system by elimination of complicated mechanical drives between engines and alternators.

▶ **Phase Adapter**—This may be used separately as the basis of a family of useful power conversion devices. For operation of three phase devices from single phase sources, where the load variation is quite small, simple condenser-reactor combinations are useful. Where larger variations are involved, self saturating reactors can be used to control phase balance to ±10 percent over the full load range. These requirements can be embodied in a static phase adapter (Fig. 7).

However, when complete regulation of phase voltages to, say, 2 percent, is required, electronic controls can be added. In this case the two added phase voltages can be maintained within 2 percent of the primary phases over the full range from no load to full load.

Another adaptation of this device is the voltage regulator-phase adapter which regulates all three phase voltages even though the input voltage changes over normal limits.

▶ **Advantages**—There are no particular obstacles in the designer's path in requisitioning these units in almost any power range, from one watt to many kilowatts. These sizes are practical, even from the standpoint of the air-

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With present tubes, and in inverters having low input d.c. voltages, efficiency is not quite as good as comparable rotary equipment. However, low voltage drop tubes are in the design stage and may be expected to rectify this fault. In inverters having the higher d.c. input voltages and in frequency changers, efficiencies are at present better than those of the superseded rotary equipment.

Fire Suit Withstands 2000-Deg. F. Flames

A new fire-fighting suit which permits the wearer to walk unharmed through 2000 F. flames and remain in 180 F. live steam for several minutes, has been successfully tested by the Naval Damage Control Training Center, Phila., Pa.

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Despite its bulky appearance, the garment weighs only 35 lb., including an oxygen rebreathing apparatus permitting the wearer to work at top speed for about 30 min., or more slowly for an hour.

Navy officials say the suit will be especially useful for fighting oil fires, shipboard fires in confined spaces, hangar and flight-deck fires, and in rescuing pilots from blazing aircraft. Another advantage over presently used asbestos suits is that it stands up well in live steam.

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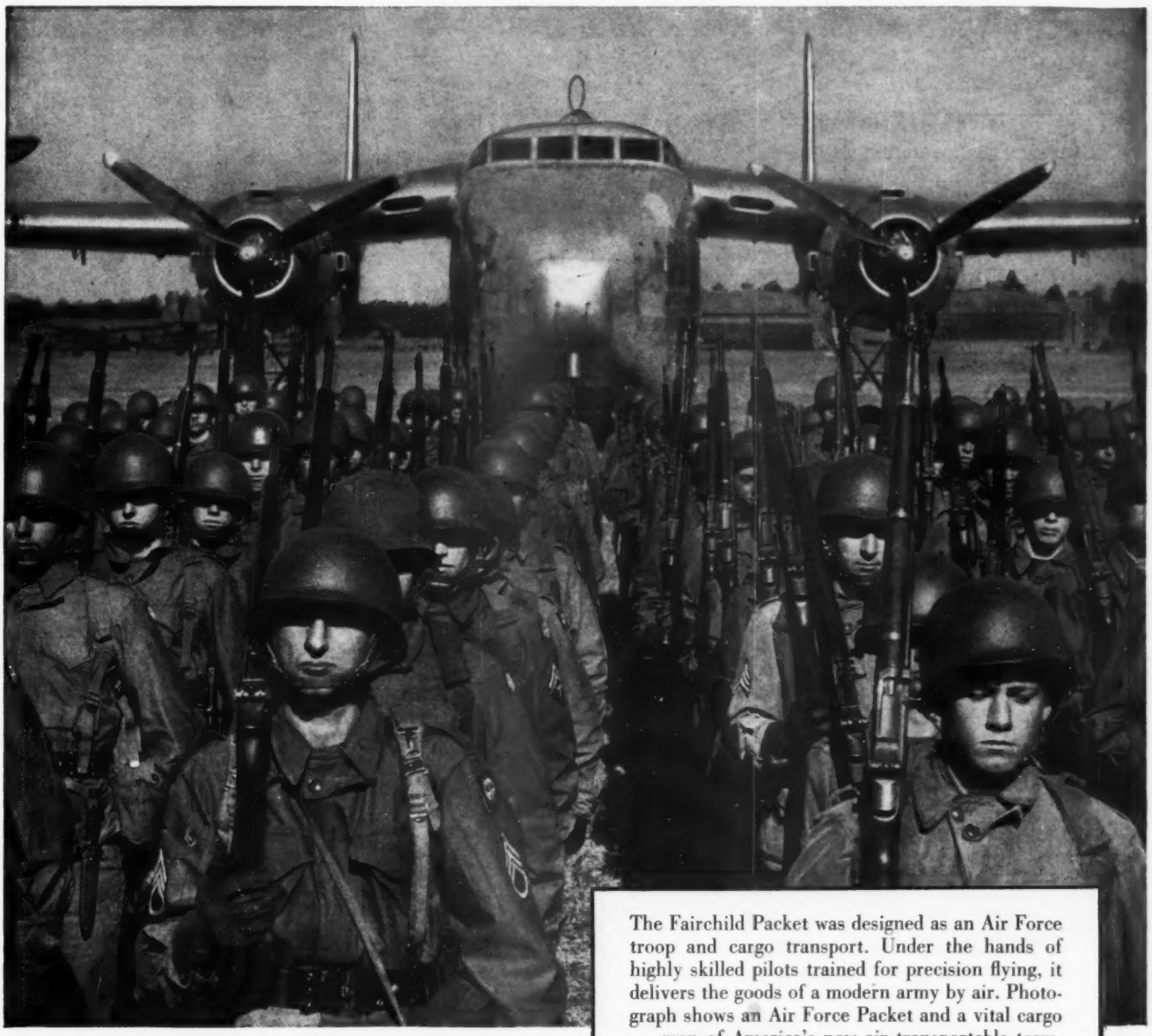

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NBS-NACA Compile Gas Thermal Data

A project to make up tables giving thermal data on wind-tunnel and jet-engine gases has been started by the National Bureau of Standards in cooperation with the National Advisory Committee for Aeronautics.

The program calls for the critical evaluation of available data and preparation of convenient tables of 13 different thermal properties for each of 13 gases. Additions to the list of gases and properties to be tabulated are expected as the project develops.

Recent advances in jet propulsion and high-speed flight have emphasized the need for accurate thermal data on gases which flow through wind tunnels or jet engines, or are encountered in the atmosphere by guided missiles. As now planned, the tables will contain thermal data on these gases: dry air, moist air, steam, hydrogen, oxygen, nitrogen, carbon dioxide, carbon monoxide, nitrogen dioxide, nitric oxide, helium, freon 12 (CF_2Cl_2), and argon.

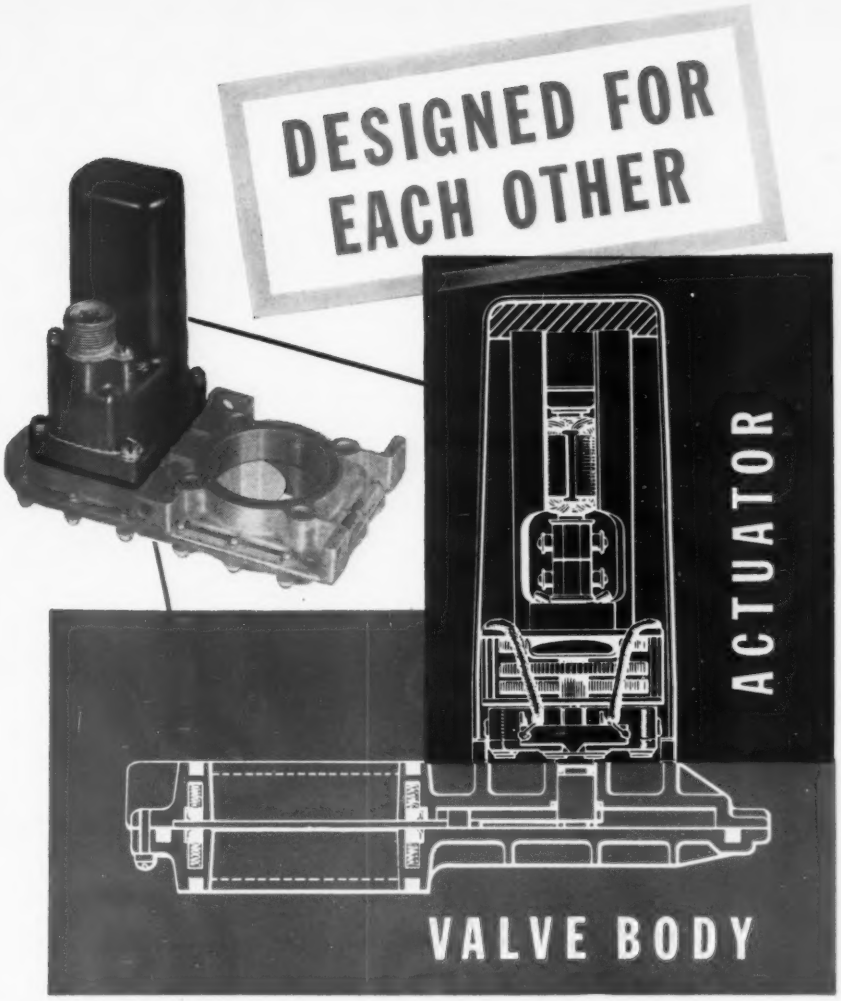
The properties to be tabulated—in general as functions of both temperature and pressure—are heat capacity at constant pressure, enthalpy (total heat), entropy, Gibbs free energy, compressibility factor, density, ratio of specific heats, velocity of sound, relaxation parameters, viscosity, thermal conductivity, Prandtl number, vapor pressure.

These data will cover a range from low pressures up to 100 atmospheres, and from very low temperatures, such as occur in high-speed wind tunnels, to 3000° K—a temperature encountered in jet engines and at the wing surfaces of high-speed aircraft.

To make tables equally adaptable to calculations in aerodynamics, heat transfer, and jet-engine problems, they will be, wherever practical, expressed in dimensionless form. Clearly labeled conversion factors will be given on the same page with the table, permitting a quantity obtained from the tabulations to be expressed in any desired units.

Suitably qualified estimates of the accuracy of the tables will be shown, even though these estimates must sometimes be very approximate. In some cases, a graph is included showing the agreement between the table and the principal experimental data.

A tentative plan for setting up the tables was first submitted to a large number of laboratories and individual scientists for comments and suggestions. After these had been received and considered, a program was evolved, which during the past year, has resulted in the preparation of 16 of these tables with three already available for general distribution. None of the tables compiled to date exceed 4 pages.



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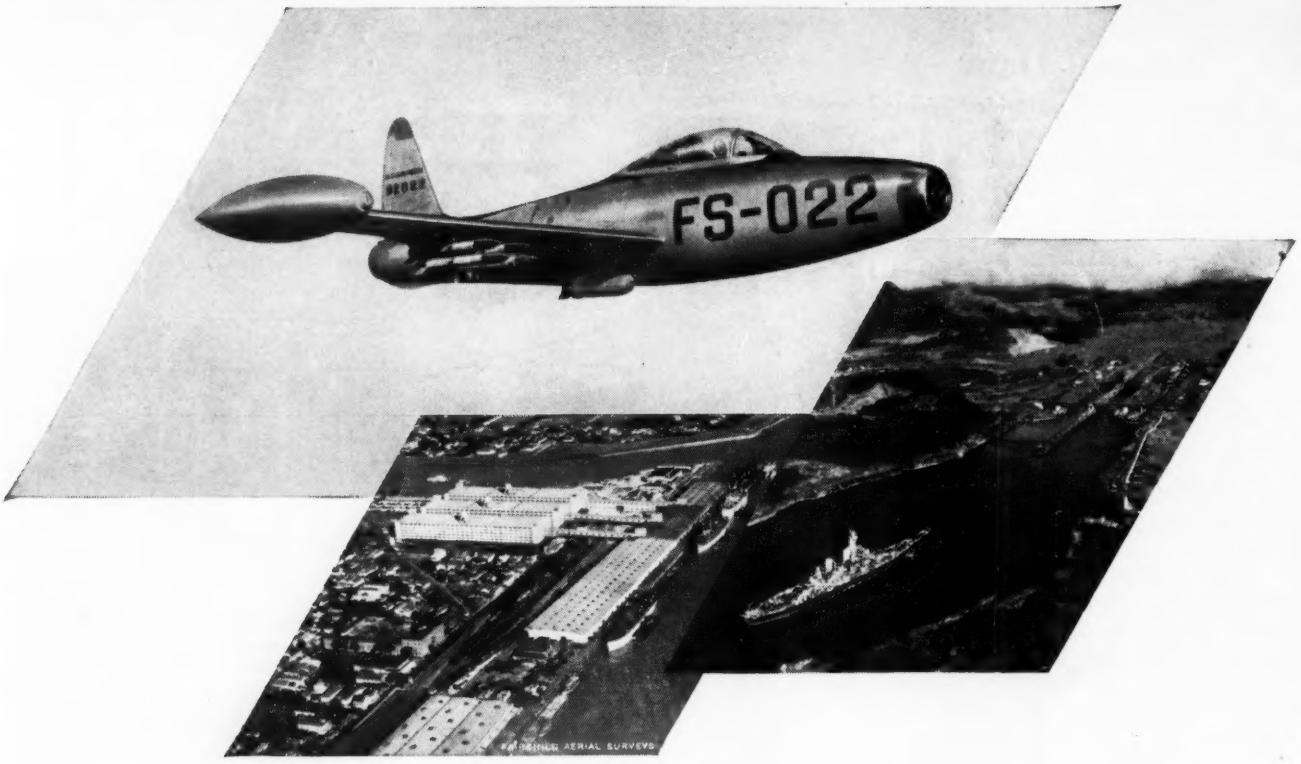

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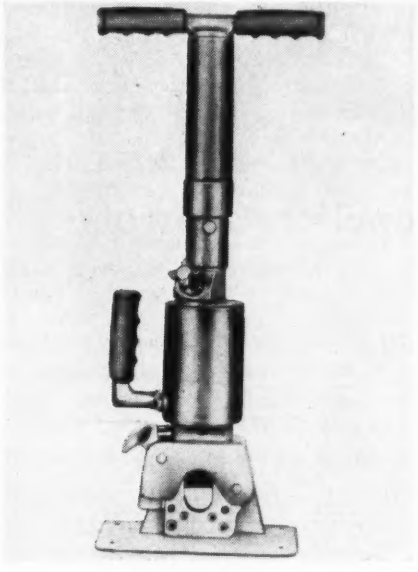
Pilot Lights Runway

Airport Light Control Radio, developed by **Grabou Electronics Co.**, Bellflower, Calif., is designed to permit pilot to turn on runway lights of unattended airport while he is approaching for a landing.

Equipment consists of ground receiver to control lights, which operates on standard frequency of 3105 kc. Outstanding feature claimed for installation is that it requires no special devices in aircraft. To turn on lights, pilot simply signals receiver by pressing "mike" button seven times in rapid succession.

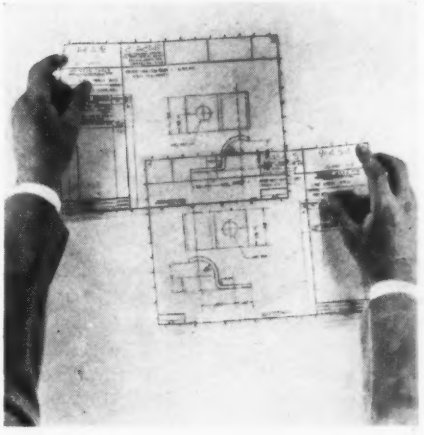
Company also offers master set consisting of two receiving sets which respond to both 3105 kc. and VHF channel 2. Reportedly priced low enough to encourage purchase by small airports, both models are distributed by **Markets Unlimited**, Beverly Hills, Calif.



Cuts Cable, Rod

For cutting wire rope up to 1¼ in. and mild steel rod up to ¾ in., **Manco Mfg. Co.**, Bradley, Ill., offers "Guillotine" portable hydraulic hand tool. Device also can be obtained with special center-cut blade for cutting ¾-in. reinforcing rod and 1 in. mild steel, and can be adapted for crimping, swaging and bending operations.

Heavy-duty tool is made from special forgings and high-tensile steel castings, yet weighs only 40 lb. It is designed to assure positive blade retraction when release valve is opened after cutting. Incorporating safety relief valve which automatically prevents damage from overloading, tool uses worker's weight to make cut.



Engineering Prints

For speedy turnout of high-quality reproductions of aircraft engineering drawings, **Eastman Kodak Co.**, Rochester 4, N. Y., has developed Kodagraph Autopositive Film.

Eliminating negative step, film produces positive copy directly from original drawing. It may be handled in normal room light and can be exposed on blueprint or whiteprint equipment, or other copying machines having high-intensity light source. Film is stated to give maximum print-back speed and easily retains fine lines and minute details because of its high translucency, high resolving power and contrast of silver-sensitized emulsion. It is especially suitable for restoring worn, faded or stained drawings without necessity of retracing by hand.

With printing speed three to four times faster than intermediates on paper, highly translucent film may be printed with emulsion side in contact with face of drawing to produce "reverse-reading" positive—print seen correctly when viewed through back surface. This feature also permits copying material printed on opaque stock or on both sides of a page.

Product has matte surface on both sides permitting additions or corrections in either ink or pencil. Erasures may be made with standard, two-solution eradicator. Film is available in 30- and 100-ft. rolls; in widths of 24, 30, 36, 42, and 44 in.

Aids Private Pilots

To simplify flight planning and cross-country navigation for private pilots, **Halpin Coairdinator Co.**, 1616 K St., N. W., Washington 6, D. C., offers two special, pocket-size computers for carrying out pre- and in-flight analysis of routes, time and distance information.

Flight and Route Plan Coairdinator is basic navigation aid, while Air Distance and Magnetic Bearing Table, with a supplementary time-distance ruler, provides cross-reference index for flying between cities.

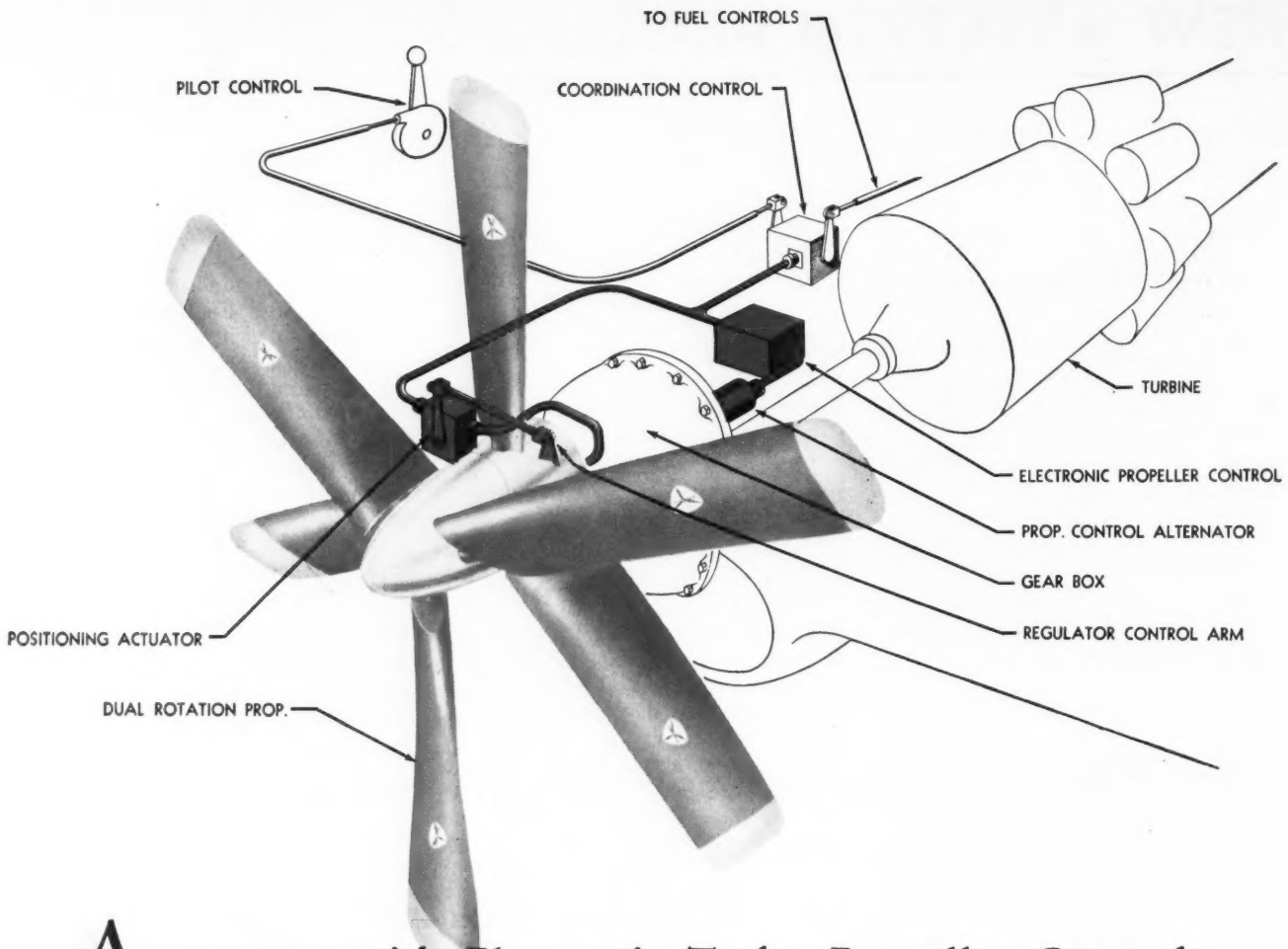
Flight and Route Plan Computer measures 7½ x 3 in. and has scales for use with aeronautical charts for direct reading of ground speeds, time intervals, off-course errors and route planning; form for writing down all information needed by pilot during flight (plastic surface permits easy erasure of pencil notes after trip); code analysis plan for reading teletyped weather reports, and precise disk slide rule for solving problems of time, fuel consumption, speed and conversion. Air Distance and Magnetic Bearing Table lists distances and bearings for flying between more than 200 cities and towns in six New England States and provides means for estimating flight distances to several hundred other points in that area. Unfolded, table is 12 x 18 in. and is first of series charting various U. S. regions. Supplementary device is plastic ruler for direct reading of time-distance and course information on aeronautical charts.

Aircraft Actuator

For positioning valves or sequence controls and other aircraft accessory units, **Barbor-Colman Co.**, Rockford, Ill., offers lightweight compact rotary actuator.

Designed to meet ANM 40, device has 50 lb.-in. torque and 300 deg. travel.

Unit is powered by 26v. d.c., 1.5 amp., permanent magnet motor, and can be controlled by inching switch, positioning rheostat or automatic temperature sensitive bridge circuit. Cam-operated switches are accessible for adjustment of actuator travel before or after installation in aircraft. Unit features dynamic braking and radio noise filter. Weight is 14 oz.



Aeroprops—with Electronic Turbo Propeller Controls

Precise Automatic R.P.M. Selection . . . RPM is automatically scheduled by the pilot's selection of an operating setting. The precise RPM for best performance and fuel economy is thus assured.

Instantaneous Control . . . Response of the system to offspeeds is instantaneous. Pitch change is obtained by biasing components which are already in motion, thus eliminating inertia and friction time lags.

Acceleration Sensitivity . . . Acceleration Sensitivity is a requirement for effective turbo propeller control because of the high inertia involved and the great sensitivity necessary to satisfy close speed limitations. The Aeroproducts control provides simple, effective acceleration sensitivity.

Complete Safety at All Times . . . Additional powerplant protection over that provided by the normal governing system is obtained from a single propeller-contained hydraulic governor of a type proven by years of service. Protection against involuntarily entering the feathering or negative thrust blade angle ranges is provided.

• *Aeroproducts Division of General Motors Corporation has developed propellers and a control system fulfilling the requirements of turbine engine installations, and provide in addition automatic synchronization for multi-engine installation. Let Aeroproducts — backed by General Motors Research — help with your Turbo-Prop planning now.*

Aeroprop

BUILDING PROPELLERS FOR AIRCRAFT TODAY
DESIGNING PROPELLERS TO MEET TOMORROW'S NEEDS

AEROPRODUCTS DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

Uniform Warplane Specs Asked

AIA poll backs definitive type specification form over deviation type. A-N outline proposal criticized.

Munitions Board action to require a unified airplane model specification form for both USAF and Navy Bureau of Aeronautics is being strongly urged by the U. S. aircraft industry.

One contractor to both military services explains his support of the proposed uniform specification in this way:

"We are convinced that variations in specification practices result in substantially higher costs in preparation and fulfillment of specifications and in delays and complications in procurement processes. . . . If these differences in preparing, publishing and applying model specifications to contracts are permitted to continue the entire value of the standardization project may be lost."

▶ **Industry Backing**—Aircraft Industries Assn. has notified the Aeronautical Standards Group of the Munitions Board that a poll of the industry backs the recommendation that the Bureau of Aeronautics adopt the present Air Force system of permitting the contractor to prepare, issue and maintain the airplane model specification.

Under this plan, the manufacturer would prepare the original specification as a draft and revise it in accordance with comments of the service concerned. He would then issue it and maintain it, including issuance of specification changes and revision of the original specification, when necessary. This would obviate the service's preparing its specification from information supplied by the contractor.

▶ **Definitive vs. Deviation**—Except for one Navy contractor, the AIA poll shows that all major military plane contractors prefer the definitive type specification now used by the Air Force to the Navy's deviation type specification.

• **Definitive** type of specification describes features of the entire airplane and references detail-design requirements in the form of specifications, drawings and other data.

• **Deviation** type of specification only partially defines the airplane. It is a basic specification citing deviations from its requirements to apply to a particular design under consideration. Except where deviations are cited, requirements of the basic specification apply.

▶ **Deviation Flaw**—Possibility for costly errors in use of the deviation type specification is pointed out. If by typographical error the number of a paragraph in the specification is omitted or changed, it may cause change in the requirements or result in conflict with other provisions of the specification.

AIA cites a strong trend toward universal use of the definitive specification in support of the industry position. Definitive "specs" are now used by commercial airlines, U. S. aircraft manufacturers themselves, and the military services of all foreign countries with whom AIA has been able to check, in addition to the Air Force.

▶ **Past Experience**—Past industry experience with the two types of specification indicates that the definitive specification is more satisfactory, "especially in times of manpower shortage when it is quite difficult to indoctrinate non-aeronautical personnel in the proper use of specifications in general and of the deviation type in particular," AIA has advised the ASG.

Industry's request for Munitions Board action has come in the form of comment on a proposed A-N outline for preparing airplane specifications which ASG had sent out for industry consideration.

▶ **Lacks Teeth**—Basic fault of the outline is that it is merely a guide without force, industry critics replied. Without a uniform specification form, the outline will only tend to encourage further non-standardization among the services, it is contended.

Unless a policy decision on the uniform specification is forthcoming from the Munitions Board, industry recommendation is that the outline project be dropped. "It no longer meets the industry's objective to conserve time, effort and money in the preparation of engineering specifications and related technical data," was the conclusion.

Dzus Charges Patent Infringement

Dzus Fastener Co., Inc. has filed suit against George Guy Whitaker and Guy Whitaker Co., Inc., charging patent infringement, trade-mark infringement and unfair competition in the sale of aircraft fasteners.

Whitaker allegedly has been making and selling fastening devices embodying Dzus patents, and imprinted with the Dzus trade-mark, without permission.

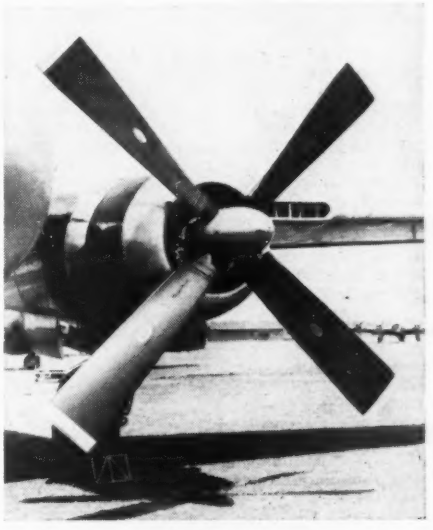
Dzus alleges that Whitaker-made fasteners were sold to Douglas Aircraft Co. and installed on Navy aircraft. "The fasteners failed and the United States Navy blamed and criticized (Dzus) for such failure," according to Dzus.

The complaint, filed in U. S. District Court Los Angeles, requests an injunction restraining patent infringements, trade-mark infringement and unfair competition; for an accounting of damages and profits with the request that damages be trebled; an award of attroneys' fees and costs; and an order requiring destruction of all merchandise, stamps, dies and tools.

Bonanza Output Cut

Beech Aircraft Corp. last week reduced its four-place Bonanza production from six to four a week, and cut its payroll back to 2250 employes, a reduction of less than 10 percent. Cutbacks are expected to enable the company to stabilize the production at the lower rate through the winter .

Beech has a $13,000,000 backlog including orders for Model 18 twin-engine transports, modification contracts for the Navy on Beech planes, and orders for several thousand jettisonable fuel tanks, in addition to Bonanza orders. The Navy reconversion contract will total about $3 million.



NEW TYPE PROP

Hamilton Standard Division of United Aircraft Corp. has developed a new type propeller (shown above) for use on turboprop engines. Propeller is mounted on a conventional piston engine for test purposes. Pratt & Whitney, another United division, is now testing its own turboprop engine, developed under a Navy contract.

Latest USAF, Navy Bid Awards

Air Materiel Command Procurement Division makes available to AVIATION WEEK the latest bid awards, shown on this page. Requests for further information should be addressed to Contracting Officer, AMC, Wright-Patterson AFB, Dayton, Ohio, attention: MCPPSX72.

ABSTRACTS

For fitting, hose, packing and sheet (50-63): Companies sharing: Goshen Rubber & Mfg. Co., Inc., Goshen, Ind., on a bid of $1505.54; U. S. Rubber Co., New York, N. Y., on a bid of $144.95; Parker Appliance Co., Cleveland, O., on a bid of $388.80; Linear, Inc., Philadelphia, Pa., on a bid of $14,277.53, and Quaker Rubber Corp., Philadelphia, Pa., on a bid of $264.00.

For stencil opaque ink (50-127): Companies sharing: Garvey Fountain Brush & Ind Co., St. Louis, Mo., on a bid of $2,103.12, and Speedry Products, Inc., Washington, D. C., on a bid of $672.

For electric connector pliers (50-155): Adams Mfg. & Enginering Co., Huntington Park, Calif., on a bid of $2700.

For gas breathing oxygen (50-33): Companies sharing: Linde Air Products Co., New York, N. Y., on a bid of $44,747.22; National Cylinder Gas Co., Chicago, Ill., on a bid of $5661.37; Air Reduction Sales Co., New York, N. Y., on a bid of $8114.02; Magnolia Airco Gas Products Co., Houston, Texas, on a bid of $9085.73; Burdett Oxygen Co., Inc., Cleveland, O., on a bid of $5856.60; Trinity Oxygen Co., Fort Worth, Texas, on a bid of $1699.11; Dye Oxygen Co., Inc., Phoenix, Ariz., on a bid of $8067.28; Southern Oxygen Co., Inc., Washington, D. C., on a bid of $1614.37; and Staurt Oxygen Co., San Francisco, Calif., on a bid of $920.43.

For bolt, bushing, clamp (49-2180): Companies sharing: Deutach Co., Los Angeles, Calif., on a bid of $3955.50; Clary Multiplier Corp., Los Angeles, Calif., on a bid of $3411.36; Lamson & Sessions Co., Cleveland, O., on a bid of $169.47; Weatherhead Co., Cleveland, Ohio, on a bid of $2080.30; Aircraft Fitting Co., Cleveland, O., on a bid of $296; Hackensack Cable Corp., Hackensack, N. J., on a bid of $1044; Ideal Clamp Mfg. Co., Inc.,Brooklyn, N. Y., on a bid of $16,372.50; Pacific Piston Ring Co., Los Angeles, Calif., on a bid of $399.50; Aeroquip Corp., Jackson, Mich., on a bid of $5920.20; Tinnerman Products, Inc., Cleveland, O., on a bid of $4150.14; Ohlam-Empire Div., Ohlson International Corp., Long Island City, N. Y., on a bid of $75.06; American Chain and Cable Co., Inc., Detroit, Mich., on a bid of $1748.10, and H. K. Metal Craft Mfg. Co., New York, N. Y., on a bid of $963.31.

For lathes and commercial literature (50-109): E. A. Kinsey Co., Cincinnati, O., on a bid of $286,056.84.

For hydraulic system test stands (50-113): Greer Hydraulics, Inc., Brooklyn, N. Y., on a bid of $50,540.

For chronoscopes and adapters (50-138): American Chronoscope Corp., Mt. Vernon, N. Y., on a bid of $3320.

For meters, voltmeters and watt-varmeters (50-153): General Electric Co., Schenectady, N. Y., on a bid of $9393.30.

For vapor type degreasers (50-93): Phillips Mfg., Co., Chicago, Ill., on a bid of $5390.

For test stands (50-67): United Mfg. Co., United Advertising Corp., New Haven, Conn., on a bid of $150,008.

For filler asemblies (49-2192): Companies sharing: Manhattan Lighting Equip. Co., Inc., New York, N. Y., on a bid of $139.66; Mines Equip. Co., St. Louis, Mo., on a bid of $69.36; Eagle Mfg. Co., Wellsburg, W. Va., on a bid of $6505.55; Duellman Electric Co., Dayton, O., on a bid of $12,026.30; Pan-American Tool & Machine Corp., Dayton, O., on a bid of $328.63; Advance Equip. Co., Cincinnati, O., on a bid of $1042.35; Mercer Glass Works, Inc., New York, N. Y., on a bid of $835; Central Scientific Co., Chicago, Ill., on a bid of $247.95; Syracuse Gauge Mfg. Corp., Syracuse, N. Y., on a bid of $5242.80; Universal Metal Products, Alhambra, Calif., on a bid of $1220.10; E. J. Brooks Co., Newark, N. J., on a bid of $224, and Ideal Laboratory Tool & Supply Co., Cheyenne, Wyoming, on a bid of $499.26.

For meters and data (50-103): Companies sharing: Reiner Electronics Co., Inc., New York, N. Y., on a bid of $13,038.80, and Weston Electrical Instrument Corp., Newark, N. J., on a bid of $580.

For photographic equipment (50-79): Companies sharing: Pako Corp., (Delaware) Minneapolis, Minn., on a bid of $1949.10; Bell & Howell Co., Chicago, Ill., on a bid of $126; Eastman Kodak Co., Rochester, N. Y., on a bid of $607.20, and J. O. Mfg. Co., South Gate, Calif., on a bid of $550.

For 10 enlargers (50-87): Simmon Brothers, Inc., Long Island City, N. Y., on a bid of $2642.90.

For grinding machines (50-107): Norton Co., Worcester, Mass., on a bid of $162,472.39.

For drill press and maintenance data (50-110): Companies sharing: Pratt & Whitney Div., Niles-Bement-Pond Co., W. Hartford, Conn., on a bid of $66,650, and E. A. Kinsey Co., Cincinnati, O., on a bid of $22,136.75.

For tester assemblies and meters (50-128): Companies sharing: Gadgets, Inc., Dayton, O., on a bid of $4909.50; Akeley Camera & Instrument Corp., New York, N. Y., on a bid of $1068.75; Monument Engineering Co., Inc., Indianapolis, Ind., on a bid of $8421.50; Weston Electrical Instrument Corp., Newark, N. J., on a bid of $580; Aerofley Laboratories Inc., Long Island City, N. Y., on a bid of $1610; Marion Screw Products Co., Marion, Ind., on a bid of $375; Aircraft Products Co., Clifton Heights, Pa., on a bid of $1900; Mansfield & Green, Cleveland, O., on a bid of $782.50, and Liquidometer Corp., Long Island City, N. Y., on a bid of $1325.

For 63 motor assemblies (50-84): D. Moody & Co., Tulsa, Okla., on a bid of $4290.

Naval Aviation Awards

Navy Department has announced award of contracts for the following aviation items:

For technical professional services of electronics field engineers: RCA Service Co., Inc., Camden, N. J., for $50,000.

For technical professional services of electronics field engineers: Philco Corp., Philadelphia, Pa., for $900,000.

For technical professional services of electronics field engineers (domestic duty only): Philco Corp., Philadelphia, Pa., for $450,000.

For oil, hydraulic: Standard Oil Co., of Calif., San Francisco, Calif., for $122,502.60.

For lubricating oil: Socony-Vacuum Oil Co., New York, N. Y., for $136,832.33.

AF Bid Invitations

Bid openings are 20-30 days after approximate issue dates shown in the following bid proposals. Bid sets containing specifications for items to be procured will be sent to qualified applicants who state bid invitation number.

One bid set will be available for examination without obligation by prospective bidders, after bid publication date, at each of the seven AMC procurement field offices. This will enable firms to see specifications before writing or telegraphing for their own bid sets.

Procurement field office locations: Boston Army Base, Boston 10, Mass.; Government Aircraft Plant No. 4, Ft. Worth 1, Tex.; 39 S. LaSalle St., Chicago 3; Wright-Patterson AFB, Dayton, Ohio; West Warren and Longo Aves., Detroit 32; 155 W. Washington Blvd., Los Angeles; 67 Broad St., N. Y. 4.

INVITATIONS

Elbow, 1-49 items, bids invitation No. 50-303, issued date Nov. 7, delivery 90 days.

Multimeter, 1-8 items, bid invitation No. 50-326, issue date Nov. 7, delivery 180 days.

Radar Receiver Assembly, 1-9 items, bid invitation No. 50-295, issue date Nov. 1, delivery 130 days.

Tester, Synchro Phasing, 1-6 items, bid invitation No. 50-327, issue date Nov. 7, delivery 150 days.

Navy Bid Invitations

The following bid invitations have been announced by the Navy Dept. Aviation Supply Office at Philadelphia. Bid forms may be obtained from the Aviation Supply Office, Oxford Ave. and Martin's Mill Road, Philadelphia. Specifications are not furnished unless requested by number.

Stainless steel welding electrodes, 111,000 lb. 5/32 in. dia. x 14 in. long; grade IV, also 124,000 lb. 3/16 x 14 in., spec. 46-E-4(Int); invitation No. 9094; bids due Dec. 2.

Steel welding electrodes, 15 items, specs. 46-E-3, -2, -4; invitation No. 9095; bids due Dec. 2.

Welding electrodes, 19 items, aluminum, steel, copper-tin alloy, tungsten, specs. 46-E-1, -12, -3, -8; invitation No. 9096; bids due Dec. 2.

Strap assemblies for R4Q-1 aircraft, 115 ea. litter webbing, inboard, dwg. 43G1953-8A; 20 ea. static line emergency release attachment, dwg. 45B9182; invitation No. 9157; bids due Dec. 1.

Brass flared tube fittings, 46 items, compression elbows, male & inverted elbows; invitation No. 9258; bids due Dec. 5.

Pivot bearings, 110 ea., .2502 in. bore dia., .7502 in. OD, Sperry Gyroscope Co.; invitation No. 9261; bids due Dec. 6.

Automotive parts, 14 items, for Clark planeloader fork truck "Transport"; invitation No. 9265; bids due Dec. 6.

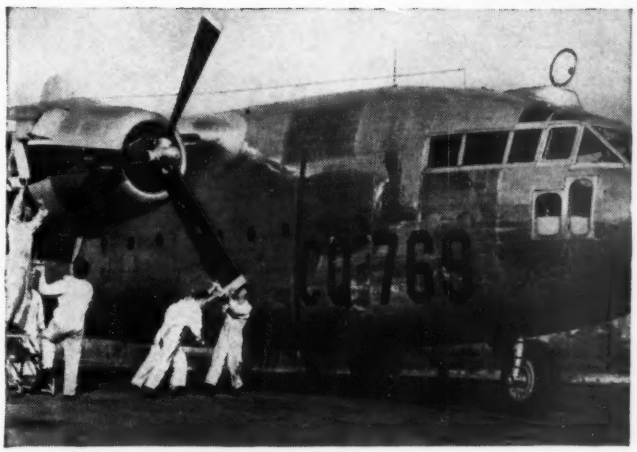
Mount-flex main engine; 115 a., for Pratt & Whitney R4360-20 engine & for R4Q-1 aircraft, Lord Mfg. Co.; invitation No. 9275; bids due Dec. 2.

Small Business

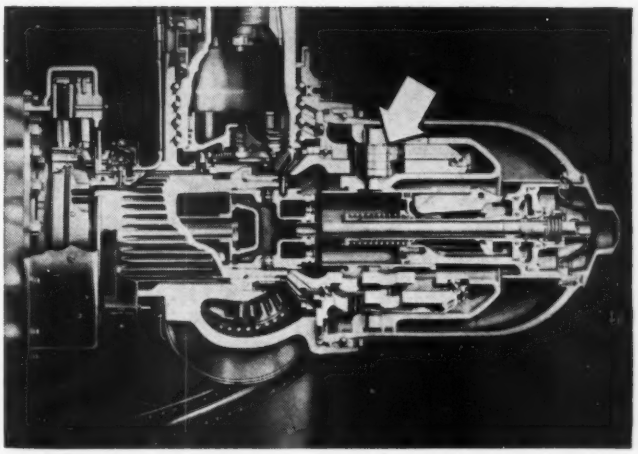
Place of small business in the government's procurement program is illustrated by the fact that the Department of the Army spent nearly half of its total procurement dollars with small firms during fiscal 1949.

Between July 1, 1948, and June 30, 1949, nearly $2 billion was spent, $846 million going to small firms.

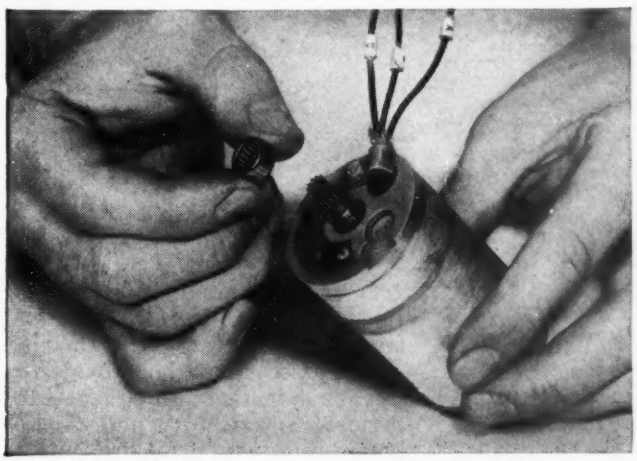
Torrington Needle Bearings provide maximum capacity in compact designs in Hamilton Standard propellers



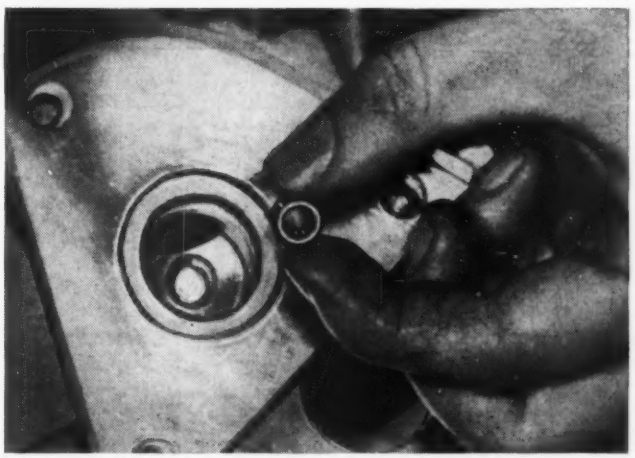
Propeller Synchronization and pitch change mechanisms must be compact, yet absolutely reliable. In several applications, Hamilton Standard Division of United Aircraft Corp. uses Torrington Needle Bearings to secure high capacity, anti-friction operation.



In Cam Roller Assemblies (arrow) of Hamilton Standard Hydromatic propellers, Needle Bearings reduce friction to a minimum. The full complement of Needle Rollers provides the high capacity necessary to carry the heavy loads involved.



A Needle Bearing is also used on the drive shaft of an electric stepmotor. Here, the Needle Bearing reduces wear and helps to maintain proper mesh between the motor shaft and gearing in an electric head which controls operation of a Hamilton Standard Hydromatic propeller governor.



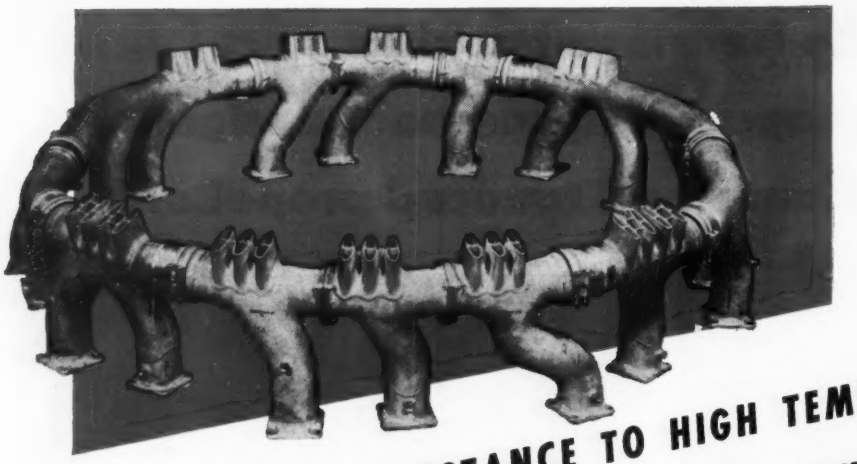
Space Limitations in this compact gear pump housing of a Hamilton Standard integral oil control assembly are easily met by Needle Bearings. With internal clearances accurately controlled in fabricating housings and shafts, this precision bearing insures close tolerance alignment of the motor pinion gear.

To secure smooth anti-friction operation in compact, high-capacity designs, use Torrington Needle Bearings. Our engineers will gladly lend a hand in design analysis and bearing selection. Write us today. THE TORRINGTON COMPANY, Torrington, Conn., or South Bend 21, Ind. District offices and distributors in principal cities of United States and Canada.

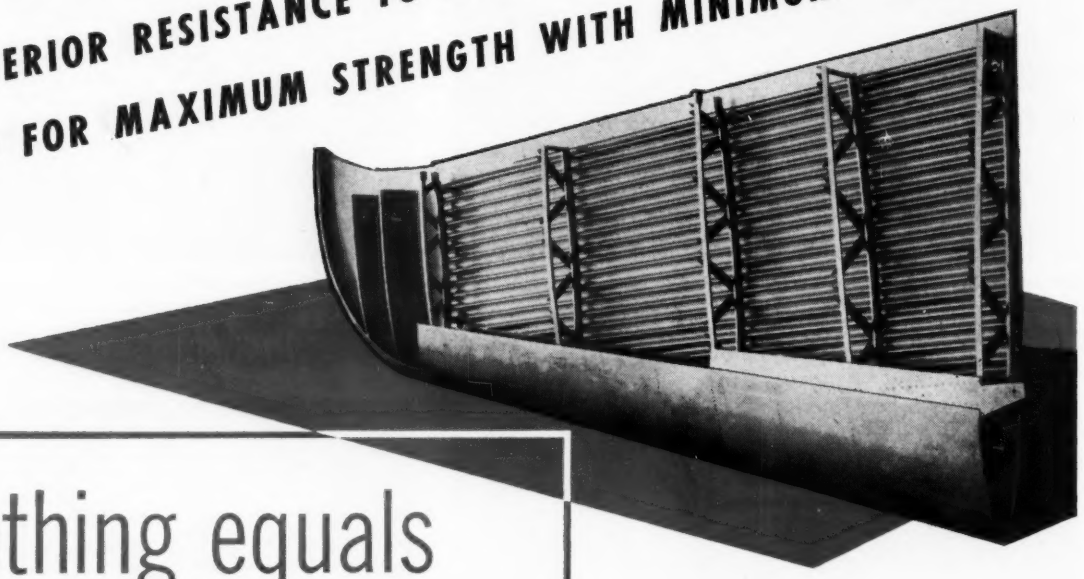
TORRINGTON *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller

Straight Roller • Ball • Needle Rollers



- FOR SUPERIOR RESISTANCE TO HIGH TEMPERATURES
- FOR MAXIMUM STRENGTH WITH MINIMUM WEIGHT



—nothing equals Stainless Steel

EVEN if Stainless Steel possessed only one of these advantages, it would merit a leading role in aircraft construction. But because this versatile metal combines both—heat resistance and an exceptionally high strength-weight ratio — it is practically *indispensable* for meeting the increasingly severe requirements of contemporary aircraft development.

In collector rings, manifolds, jet engine housing parts, exhaust flash boilers for cabin heaters, and exhaust stacks . . . in all parts that must undergo exposure to extremely high temperatures . . . Stainless Steel offers unsurpassed resistance to corrosion, wear, cavitation and fatigue.

Used in structural members, fuselage skeletons, wings spars, struts, and rudder, elevator and stabilizer frames, Stainless saves critical pounds while giving these vital parts exceptional strength and stamina. And Stainless permits fast fabrication by spot welding—20 to 100 times faster than riveting — thus making assembly costs substantially lower.

Take advantage ofthese benefits of Stainless Steel construction. And to obtain maximum performance from such assemblies, fabricate them from U·S·S Stainless Steel. Laboratory techniques applied to modern production methods give U·S·S Stainless a uniformity in finish, composition and fabricating quality that's unsurpassed. Our engineers will gladly assist you in fitting U·S·S Stainless Steel to your design.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO · CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO · NATIONAL TUBE COMPANY, PITTSBURGH · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

9-1639

UNITED STATES STEEL

Pilot Protection Guides New Craft

Texas A & M will follow design recommendations of Hugh De Haven in sprayer plane development project for CAA.

Pilot protection in the event of a crash will be a special design feature of the new agricultural airplane being developed at Texas A & M College for CAA and the Department of Agriculture.

Prof. Fred E. Weick, head of the Personal Aircraft Research Center at the college, recently conferred with Hugh De Haven of Crash Injury Research in New York, obtaining from him a list of specific design features for pilot protection in the event of a crash.

▶ **Safety Features**—The experimental duster and sprayer plane is expected to be designed so that the pilot will not have any load behind him, and so that there will be crash absorbing structure ahead of him. Shoulder straps, instrument placement so as to avoid contact with the pilot's head in event of a crash, and other safety principles advocated by De Haven will be used.

The New York safety researcher has been invited to examine the preliminary design and criticise it from a crash-protection standpoint, in the next few weeks.

▶ **Structure Preference**—Indication from commercial spray and dusting operators that they prefer steel tubing fuselage with easily replaceable covering may result in a change in the structure from the projected conventional all-metal construction to a steel tube fuselage with either fabric covering or detachable metal covering.

Preference by operators is on account of easier field maintenance. Still being considered however is the probability that field maintenance for all-metal plane construction will have improved considerably by the time the improved sprayers and dusters get into operation in any quantity, due to the increased number of small all-metal aircraft.

▶ **Power Plants**—Airplane is expected to be able to mount any of several engines, among them a Continental E-185; a geared Lycoming GO-0435, a geared version of the Continental E-185 which is now under test but has not yet received CAA approval; or the radial Continental W-670. The flat engines are preferred over the radial because of better visibility for the pilot over the nose, but the radial is an alternate installation because of the reliability record of this particular engine.

O. K. Hedden of the U. S. Department of Agriculture at Toledo, is expected to take charge of the development of improved spraying and dusting equipment which is to be carried on concurrently with the plane development. The dispersal equipment will be developed following exhaustive distribution measurements.

▶ **Hoppers and Tanks**—Alternate locations of dust hoppers either in the wings or in the fuselage are being studied. Visibility will be improved if it is not necessary to carry the hopper in the fuselage. Spray tanks will be in the wings.

A dust-or-spray load of 800 lb. is indicated for the prototype, although original plans considered carrying as big a load as 1200 lb. with overload up to 1700 lb. It was decided that such a load would require a plane of around 4000 lb. gross wt. and an engine of 300 to 450 hp. depending on the type of operation. The larger plane would have cost around $17,000 it is estimated, after present war surplus supplies are exhausted. The 800-lb.-payload plane probably will cost around $10,000.

▶ **More Features**—Other features expected to be incorporated into the plane include:

- **Strong soft landing gear** with simple, effective brakes, and large wheels and low pressure tires for takeoff from soft, rough fields.
- **Control surfaces in dispersal bath** are to be metal covered and bonded.
- **Quick easy loading** design features for both spray and dust, including an engine driven pump to load the spray.
- **Performance** to include approximately 800 ft. takeoff, 100 mph. cruise, operating speed of 70-80 mph. or slower, 2-3 hr. range, good maneuverability and control at low speeds, with ability to pull up steeply and make quick turns without stalling.

Tree Seeding

Central Aircraft of Yakima, Wash., has been hired by Crown Zellerbach Corp. to seed 5200 acres of privately-owned logged or burned over timberland in Oregon and Washington. The lands serve the company's paper mills in Camas, Wash., and West Linn and Lebanon, Ore.

BRIEFING FOR DEALERS

▶ **Fourth Region Preference**—Bill Berry of CAA's Fourth Region, took a poll of approximately 100 aircraft operators out Texas way to see what they liked in the way of agricultural planes, for spraying, dusting, etc. Here's how they expressed their preferences:

High wing, 53; low wing, 6; biplane, 45; span of 25 to 30 ft., 11; 30 to 35 ft., 49; 35 to 40 ft., 44; fuselage construction, fabric 57; monococque, 18; metal-covered, 39; wing construction, fabric-covered, 80; metal, 10; monococque, 18; dust load, 600 to 800 lb. 57; 800 to 1200 lb., 45; operating speed, 40-60 mph., 9; 60-80 mph., 65; 80-100 mph., 35; maximum takeoff, 800 ft., 31; 1000 ft., 40; 1200 ft., 21; landing speed, 40 mph., 29; 50 mph., 54; 60 mph., 24; engine hp. less than 185, 21; 185-200, 22; 240-300, 20; 300-450, 23; price, $2000-$3000, 49; $3000-$6000, 46.

▶ **Un-clipping the Clipper**—Piper Aircraft has received over 500 suggestions thus far for a new name for the best-selling 115-hp. four-place Piper Clipper. Company has decided to change the name for the new 1950 model of the four-placer, reportedly because Pan American Airways objects and claims prior use of the name.

▶ **Five Aeroncas**—Aero Club of Ecuador has taken delivery on one Aeronca Sedan, three two-place side-by-side Chiefs, and one 90 hp. Champion tandem for flyaway to Ecuador.

▶ **Accident Trend Up**—In first 2000 non-air carrier accidents reported in 1949 by CAB there were 195 fatal and 136 serious injury accidents, as compared to 191 and 112 respectively, in the first 2000 accidents for 1948, showing increase in fatalities of from 9.5 to 9.8 percent and in serious injuries, from 5.6 to 6.8 percent.

▶ **Airwork Continentals**—Production of approximately 20 engines a month in the Airwork Corp. re-manufacturing line for Continental E-185 engines is expected by first of the year.

Airwork recently delivered its first exchange engine from the line to Nutmeg Air Transport, Inc., Bristol, Conn. which flew in a Beech Bonanza one day, traded engines and flew out with a reworked powerplant the following day.

▶ **Buffalo Merchandising**—Airport Advisory Board at Buffalo is looking for means to increase revenue at Buffalo Municipal airport. New project to enlarge administration building, providing more space for non-aviation shops and merchandise counters is underway. Recently board authorized a barber shop, and automatic dispensing machines.

—Alexander McSurely

MORE DEVELOPMENTS IN

fighting airfield fires

THE LATEST "PYRENE" AIRFIELD CRASH TENDER

This "PYRENE" Aircraft Crash Tender embodies many new improvements in design and construction. Built on a Thornycroft "Nubian" four wheel drive chassis, it is capable of rapid transit over rough or soft ground. It carries— ● 500 gallons of water ● 40 gallons of Foam Compound ● Two M.F.G.15 "PYRENE" Mechanical Foam Generators ● Six 50-lb. CO_2 Gas Cylinders each with 100 ft. of hose, hose reel and gas distributor. It is fitted with a 350/500 G.P.M. pump driven by power take-off from the prime mover.
This tender delivers 3,500 gallons of foam and 2,400 cu. ft. of CO_2 gas in $1\frac{1}{2}$ minutes. With a crew of 5 trained men it can be brought into action within 7 to 9 seconds.

Full details and specification will be sent on application to Dept. A.W.

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Electronic Pilots Back in Service

Three months' intensive tests result in modifications that airlines believe will give improved instruments.

Improved electronic autopilots are being returned to service by most of the U. S. and foreign airlines which disconnected them three months ago. Tests and modifications, carriers and manufacturers agree, have made possible a much more satisfactory instrument.

Another important by-product of the three months' survey and investigation of electronic autopilots, according to one company making the device, has been improved liaison between airlines, instrument makers and airframe manufacturers. This offers promise of continuing cooperation on many problems which are interrelated, but which until now have been studied separately by the three parties.

Eclipse-Pioneer division of Bendix Aviation Corp. has completed its intensive testing of the PB-10 (one of the two electronic autopilots involved), while Sperry Gyroscope Co. still is running tests of its A-12 on Boeing Stratocruisers, Convair-Liners and other transport planes. Most of PB-10 work was done on a KLM Lockheed 749 Constellation.

▶ **Started at Bari**—Although both Sperry and Bendix for some time had been running routine investigations seeking to improve their autopilots, the airlines and airframe manufacturers first participated in the work last summer, following the crash of a KLM Lockheed 749 Constellation at Bari, Italy, in June.

Cause of this accident has never been determined and there is no evidence that the autopilot (in this case the PB-10) was involved. But the unusual circumstances made KLM suspect every part of the aircraft, its components, and its operation. The crew had reported no malfunction. There was no fire aboard, weather was excellent, but the plane literally fell out of the sky.

Weeks later, a Pan American Stratocruiser, en route to London, suddenly went into a nose-down attitude while on the autopilot (in this case an A-12). Meanwhile, another KLM Connie had experienced an unusual maneuver while the autopilot was engaged. These incidents, plus, as Bendix says, "lack of evidence to the contrary" as to the cause of the Bari crash, put the spotlight on the electronic autopilot.

▶ **Industry Project**—The manufacturers of both airframes and instruments, as well as the operators, moved promptly. Lockheed advised all operators of 649 and 749 Constellations to discontinue use of the PB-10 until evaluation could be made of intensive tests. Boeing advised Northwest similarly regarding the PB-10 in the Stratocruiser. Pan American disconnected the A-12 in its Stratocruisers and so did American Overseas Airlines. Convair instructed Swissair to stop using the PB-10 until completion of the tests. Douglas advised operators of its aircraft to exercise caution, but decided that it was unlikely that autopilot malfunctioning could impose loads exceeding the structural limitations of its planes.

Sperry and Bendix, with the airframe manufacturers and operators, laid out a series of tests. Civil Aeronautics Administration was informed of the situation and agreed to the proposed procedure. To date, it has been an industry project, with CAA an observer. There is not, and has not been a ban on the use of electronic autopilots.

▶ **Words of Caution**—After studying the matter, some airlines at first continued to use the autopilots, but with precautionary instructions to their pilots: Seat belts must be fastened at all times during flight; autopilots were to be disengaged below certain minimum altitudes or at the first sign of a malfunction. But as the investigation continued, even these lines ordered the disconnection.

These measures stemmed from one discovery about the performance of electronic autopilots such as the PB-10: Any one of a number of failures, such as shorting of the power transformer, shorting between follow-up wires, grounding of the servo follow-up unit, or loss of Autosyn excitation, could cause single or multiple surface hard-over signals. These produced maneuvers ranging from mild to violent.

The disconnection or precautionary orders were issued for two reasons:

• **Danger of excessive load factors** following a hard-down signal on the pitch axis. Because of clean design of modern transports, a rapid increase in airspeed results from a sudden nose-down movement. Without immediate correction, possibility existed of exceptional loads in recovery.

• **Danger to crew** when a strong nose-down signal was transmitted. It was found the motion was rapid enough to produce less than zero G conditions in the cockpit. This would unseat the pilots and other crew members if belts were not fastened.

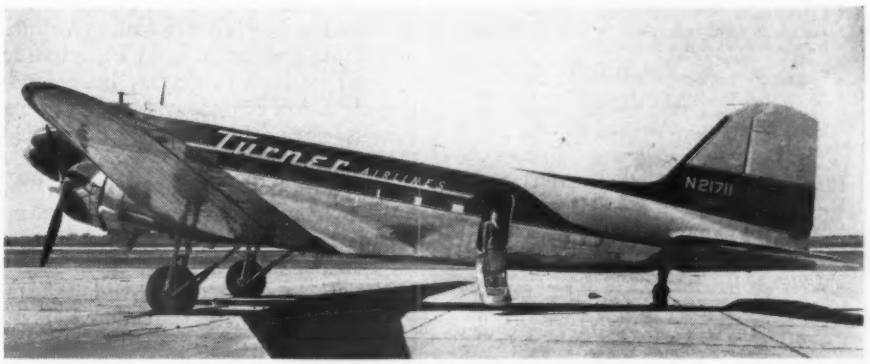
▶ **Maneuvers**—During the flight tests, several noteworthy results were obtained by the various planes and electronic autopilots used:

• **Elevator channel** was fed a hard-down condition when plane was in level flight at 185 mph. Plane reached minus 0.1 G and 238 mph. in 2.3 seconds.

• **Aileron channel** transmitted hard-over signal and produced a smooth roll at a rate of approximately 6 deg. per second.

• **Directional channel** failure produced rather rapid yaw or bank, depending upon whether the autopilot actuated the rudder or elevators. Recovery by the human pilot was accomplished without undue difficulty.

▶ **Modifications**—As a result of the tests,



TURNER READY FOR BUSINESS

Turner Airlines, which has taken over the short-haul franchise originally issued to Roscoe Turner Aeronautical Corp. in February, 1948, planned to start DC-3 service between Indianapolis and Grand Rapids, Mich., this month. R. Paul Weesner, executive vice president, indicated that Turner would inaugurate scheduled feeder operations on other links from Louisville, Ky., to Chicago and from Indianapolis to Cincinnati—around the first of next year. Turner plans to operate single-engine Beech Bonanzas over the Louisville-Chicago route until airport conditions permit use of DC-3s.

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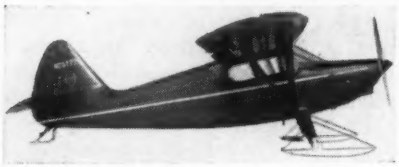

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Federal Skis assure practical, safe, and efficient continuous operation of aircraft throughout the winter months. Through year around airplane operation which skis afford, airplane ownership is more fully justified and warranted.

FEDERAL presents the only complete line of skis available

Standard and custom-built models include

- **Fixed Position Wheel Replacement Types.** Standard models for Aeronca, Beaver, Bellanca, Cessna, Chipmunk, Fairchild, Fleet Canuck, Funk, Luscombe, Seabee, Skyranger, Stinson, Swift, Taylorcraft, and other popular makes.

  Note: An axle adapter arrangement and universal rigging permits interchangeability of various aeroplanes within the gross capacity of each ski model.

- **Tricycle Gear Types.** Standard models for Ercoupe. Custom-built models for Navion and others.

- **Combination Wheel-Skis.** Standard models for Cessna Model 170, Norseman, Stinson. Custom-built models for Aeronca, Anson, Cessna Model 195, Luscombe, Navion, Piper and others.

- **Retractable Wheel-Skis.** Custom-built models for Douglas DC-3, C-47, R4D, Dakota, Fairchild C-82, Northrop, and other transport aircraft.

- **Clamp-On Wheel Types.** For light planes equipped with 6.00 x 6 and 8.00 x 4 tires and wheels.

- **Shock Absorbing Pedestal Types.** Custom built fixed gear models for Bellanca, Beech, Beaver, Twin engine Cessna, Fairchild, Norseman, Waco and others.

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modifications are being made on the two electronic autopilots and they are going back into service as quickly as the work is completed. For the PB-10, main changes involve rewiring certain circuits to reduce the possibility of shorting or grounding; putting the compass signal on the aileron rather than rudder channel to reduce maximum rudder forces; incorporating a ruggedized rectifier tube in the amplifier and addition of a plate supply monitor to reduce the possibility of simultaneous three-surface hard-over signals.

Perhaps even more important than these are two other modifications, one being made, the other proposed:

- **A resistor** will be installed on both types of autopilots to reduce the forces produced on all three controls.
- **A G monitor** is being tested and if installed would automatically disconnect the autopilot when it transmitted forces that would impose loads approaching the design limits of the particular airplane.

Both Bendix and Sperry have such a "G cut-out" under development. Sperry has been testing it in its company research plane for more than a year. It has not yet firmed up any intention to market the device. Bendix feels the monitor is unnecessary, but undoubtedly would produce it on demand.

Target Tabor

He is alleged to be power behind group of nonsked violators.

Edward Ware Tabor, who lays claim to being the founder of nonscheduled skycoach operations and the $99 coast-to-coast fare, has again become a major target of Civil Aeronautics Board enforcement officials.

Founder of Tabor Luxury Airlines and Trans-Luxury Airlines early in the postwar period, Tabor has been fending off CAB crackdowns with varying success since 1946. Trans-Luxury had its letter of registration suspended early in 1948, but Tabor, engaging in new enterprises, has continued to be an almost legendary figure in the cut-rate air transportation field.

► **Violations Alleged**—In its latest enforcement move, CAB ordered Trans American Airways, Great Lakes Airlines and Golden Airways, all of Burbank, Calif., to show cause why their respective letters of registration should not be revoked for "knowing and wilful" violations of the Civil Aeronautics Act. The Board also ordered Tabor and Sky Coach Airtravel, Inc., a ticket agency, to show cause why they shouldn't be told to cease and desist from engaging in air transportation within the meaning of the law.

Tabor reportedly is president and his wife is secretary-treasurer of Trans American, a transcontinental nonsked. CAB enforcement officials say Sky Coach Airtravel, Inc., successor to Sky Coach Limited, is also controlled and operated directly and indirectly by Tabor through his nominees as officers and directors, through leases, credits "and other means."

► **Combination Seen**—Since Jan. 1 of this year, Trans American and Great Lakes allegedly have been operating individually and in combination between San Francisco, Los Angeles, Chicago and New York with greater frequency and regularity than is permitted under nonscheduled regulations.

Board enforcement officials claim nearly all passengers secured from the general public by Sky Coach Airtravel, Inc., were provided with air transportation on a C-46 and a DC-3 owned or controlled by Trans American, Great Lakes and Tabor.

► **Plane Ownership**—The C-46 allegedly is registered with CAA as being owned by Air International, Inc., a Nevada corporation, whose stock is owned 50 percent by Tabor and his wife and 50 percent by Irving E. Herman and his wife. Herman is president and his wife is secretary-treasurer of Great Lakes.

The DC-3 is registered with CAA as being owned by Air Tours, Inc., a New York corporation reportedly owned and controlled by Tabor.

According to CAB, the two planes have the name "Sky Coach" painted on them and have been operated alternately by Trans American, Great Lakes, Tabor and Sky Coach Airtravel, Inc., —being transferred back and forth by arrangement between them.

► **Ticket Alteration**—Board officials say Tabor and Great Lakes have had an understanding or agreement for combined operations since the spring of 1948. In flights operated by Trans American, Great Lakes, Tabor and Sky Coach, the ticket offices and passenger-handling facilities of Sky Coach Airtravel, Inc., which advertises extensively, allegedly are used. It is charged that tickets and exchange orders are altered at the time of flight to reflect the name of the carrier purportedly operating the particular trip.

► **Golden Cited**—CAB enforcement officials claim that Trans American, Great Lakes, Tabor, Sky Coach and Golden Airways some time prior to last Sept. 17 entered into an arrangement for "further evading the Board's economic regulations."

► **Traffic Disclosed**—Trans American during the first half of 1949 flew 3885 passengers 8,507,029 revenue passenger

PLANE FAX

How Central Air Services Cuts Repair Bills

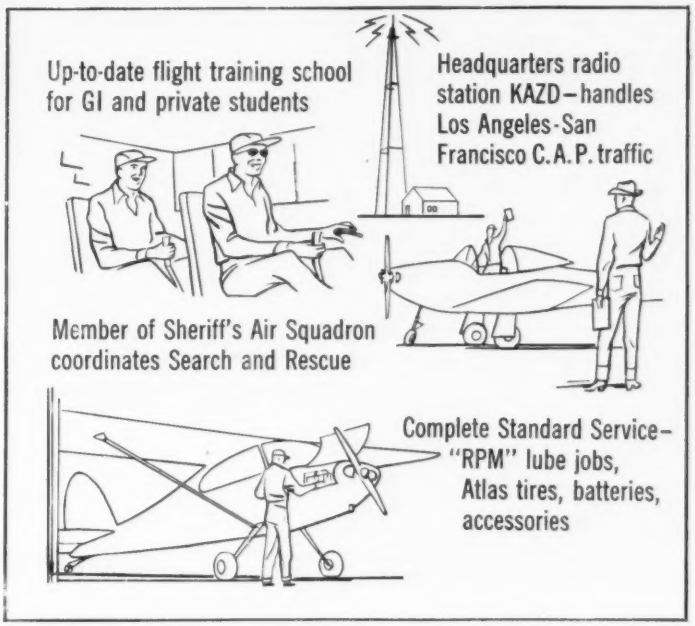
Frank E. Furlong, owner of Central Air Services at Furlong Field, Fresno, California, tells how RPM Aviation Oil helps cut maintenance costs on the 75 planes at his field. "We have used 'RPM' since it has been on the market and have never known what it means to have a sticky valve. That goes for our many customers, also.

"Our engines have run many hundreds of hours on 'RPM' and maintenance has been kept to a minimum. We have an 85 H. P. engine that was torn down for a major overhaul after 1500 hours and the cylinders were worn less than a two-thousandth of an inch.

"After these wonderful results, it's a pleasure to recommend 'RPM' aviation products to all our customers."

Quick picture of

FURLONG FIELD Fresno, Calif.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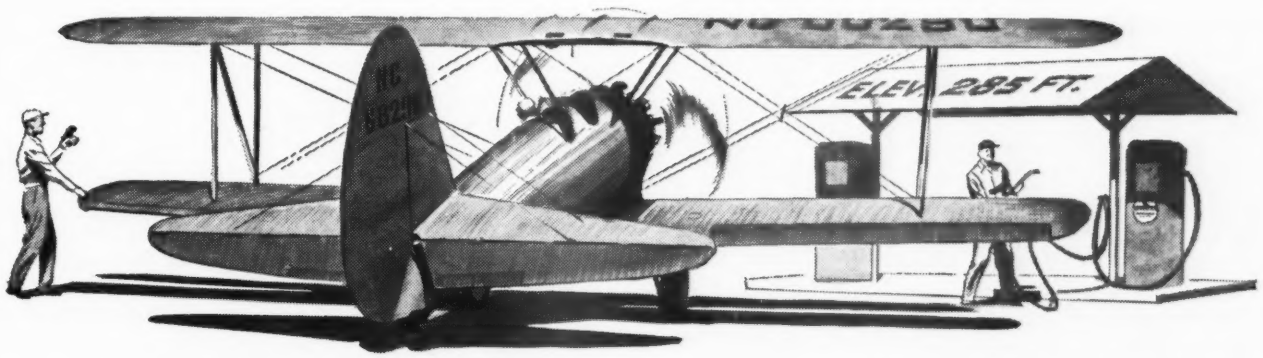

Tip of the Month

"How to make your gasoline give you greater flying range"

"We've found that Chevron 80/87 Gasoline is so efficient that we can lean out the mixture in our small planes at high altitudes, which reduces the fuel consumption and lets us fly farther on a tankful of gasoline."

—Frank Furlong,
owner, Central Air Services, Furlong Field.

All "Furlong" planes have switched to new Chevron 80/87 Gasoline—now get peak power for less money

"We're all glad that Standard came out with the new Chevron 80/87 Gasoline," Mr. Furlong writes. "We're using it in our Pratt and Whitney 450 engines which once required 91/98 fuel. Now when we fly our BT-13 trainers and crop-dusting Stearman, we get full power without any detonation—with a lower-priced gasoline."

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Page after page of parts drawings and detailed photographs of actual applications classified by type . . . significant case histories on SPEED NUT* savings . . . and details on the Tinnerman Fastening Analysis Service. It contains all the data about the amazing SPEED NUT brand of fasteners that are helping a top-ranking car manufacturer save an estimated 3 million dollars this year . . . that cut assembly time 30% for another company . . . that saved $50,000 in equipment investment for still another.
If you're interested in seeing this guidebook of fastenings, call your Tinnerman representative—he's listed in major city phone directories, or write: TINNERMAN PRODUCTS, INC., 2040 Fulton Rd., Cleveland 13, O.

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miles, having gross revenues of $332,732 and a $32,993 net profit. It listed 37 employes as of last June, total assets of $47,645 and liabilities of $41,214. Capital stock outstanding aggregated only $2340.

Both Trans American and Great Lakes have asked CAB for certificates to conduct scheduled transcontinental coach service.

Boeing Minimizes British Jet Lead

Boeing Airplane Co. has taken another long look at foreign jet transport developments and now believes Great Britain's lead in the field "may not be as serious as first expected."

Wellwood Beall, Boeing's vice president in charge of engineering and sales, concedes there is no question that the British are currently setting the pace with their turbine-powered commercial airliners. But he points out that American manufacturers are still in a good position to win the jet transport sweepstakes if they start now.

"Britain," Beall declared, "is firmly committed to a course of action on specific jet transport types. We believe we can take advantage of that fact if immediate action is taken to establish a U. S. program which will provide the financial backing required to initiate prototype development and production.

▶ **No Money**—"In other words, we can pick up where they left off and bring out an improved airplane. The one big

Harris Agrees

If America gets a turbine-powered transport aircraft program underway immediately, design and construction will be completed in time to out-do the British, even with their head-start, according to Harold R. Harris, vice president and general manager of American Overseas Airlines.

Harris, speaking at a recent Flight Safety Foundation meeting, recommended that American operators—both civilian and military—should combine with American manufacturers to design at least two types:

- **A medium-range aircraft** carrying 50 passengers for 1850 miles, with considerable fuel reserve for head winds and alternate airports;
- **A trans-Atlantic airplane** carrying the same number of passengers for 3500 miles, against average head winds and with suitable reserves.

problem is money. We have the technical know-how, the engineering talent, the facilities and a great deal of enthusiasm for the future of such a project."

Beall said Boeing is interested in developing a superior jet transport design regardless of whether the funds are made available through organized industry support, promotion of suitable prototype legislation in Congress, or by commercial customers.

Boeing last month broke the virtually solid opposition of U. S. plane builders to a government-financed commercial prototype development program. But other major transport manufacturers, such as Douglas and Lockheed, remain unenthused about prototype legislation.

▶ **Target: 18 Months**—Beall declared his firm could have a prototype 500-mph. jet transport flying within 18 months after receiving a contract. It would take an additional two years to put the 40- to 50-passenger ship through its tests and into regular airline service.

British jet transport manufacturers don't expect to have their craft in commercial service until 1952 or 1953. Thus the 42-month catch-up period required by American plane builders would enable them to have a "superior design" in operation soon after the British, according to Beall.

Boeing disclosed it now has on its drawing boards advance-type jet transports "which are the next logical step ahead of anything now flying abroad." The company believes the planes are not only feasible economically from the commercial viewpoint but "absolutely essential militarily to a well-rounded defense setup."

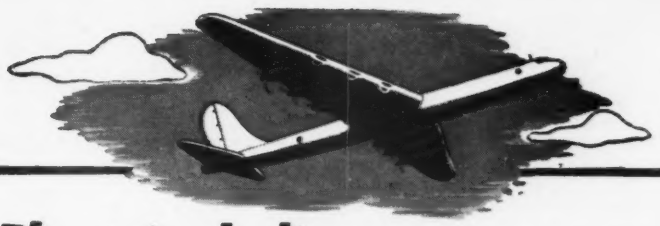
Beall said the 500-mph. jet transport Boeing could have flying in 18 months would be suited to all hops from 200 to 2500 miles. He emphasized that no U. S. company can risk its own capital to build such a plane.

How Harris Sees 1955 Transport

The ideal long-range, 1955-model airline transport should cost not over $2 million per unit and have a flexible cabin arrangement accommodating either 50 regular-fare passengers or 100 coach-fare travelers, according to Harold R. Harris, American Overseas Airlines vice president and general manager.

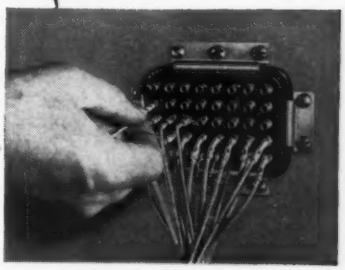
Harris cautioned engineers not to design an airliner for 1955, 1965 or any other time which would force the carriers to raise their fares. "We will continue to have a healthy industry only if fares become lower—and lower—and lower," the AOA executive emphasized.

▶ **Specs**—Here is what Harris wants in his 1955 model long-range, trans-ocean transport design:



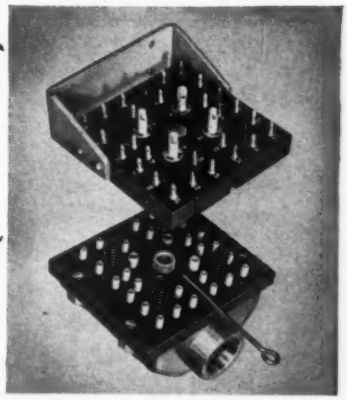
Electrical disconnect panels by BURNDY

Pressurized bulkhead panels



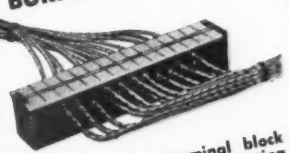
Burndy pressurized bulkhead panels feature positive locking of individual connections in the connector sockets; easy circuit identification. Pins for connection to panel are made for the popular conductor sizes. Several sizes of panels are available. Approved by USAF.

Expendable panels for fuel tanks and missiles



Burndy UMBILICAL DISCONNECTS for guided missiles, and DISCONNECTS for disposable fuel tanks, can be designed to specifications. Standard types are supplied to accommodate a variety of conductors for many voltages and currents. These disconnects consist of two parts, a stationary panel and an expendable portion which can be jettisoned by an electrical or mechanical release mechanism.

BURNDY Crablok



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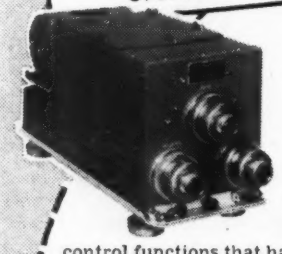
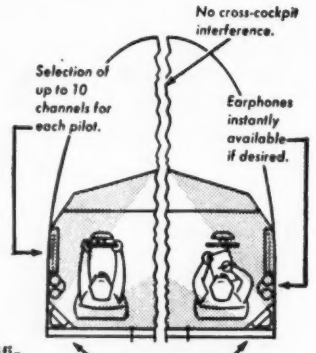
A DECADE OF PROGRESS

TO PILOTS OF TWO-PILOT AIRCRAFT, AND AIRCRAFT RADIO SYSTEM ENGINEERS



NEW FREEDOM OF CONTROL
LESS PILOT FATIGUE
with the Type F-11 Isolation Amplifier
CAATC No. 1R4-1

The new A.R.C. Isolation Amplifier performs two important radio control functions that have long presented problems. (1) Each pilot has **independent** selection of up to ten audio input channels in **any combination**—without cross-cockpit interference. Radio functions may be delegated so that each pilot works at peak efficiency in complex navigational and communication situations. (2) It operates individual cockpit speakers, with earphones instantly available if desired. Since the CAA no longer requires wearing of headphones when cockpit speakers are installed, the A.R.C. Isolation Amplifier relieves pilots of considerable discomfort and fatigue—particularly in hot weather and on long flights.


No cross-cockpit interference.
Selection of up to 10 channels for each pilot.
Earphones instantly available if desired.
Individual speaker operation for pilot and co-pilot.

Weight: 8 lbs. CAA Type-Certificated. Immediate delivery in 14 or 28 volt dc models. Complete technical details on request.

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Aircraft Radio Corporation
BOONTON, NEW JERSEY
DEPENDABLE ELECTRONIC EQUIPMENT SINCE 1928

• A low-wing monoplane with not over 50 sleeperette-type seats and carrying 2500 lb. of mail and cargo in addition to 150 lb. of baggage for each passenger.
• No berths for either passengers or crew; a lounge seating ten persons; separate toilet arrangements for men and women; and hot-meal facilities with necessary storage and serving space for two meals for a full plane.
• Ample space for coats, hat racks, passengers' personal belongings, life jackets, pillows and blankets; separate reading lights and call-buttons at each seat; and a public address system adaptable for carrying "canned" music.
• Not over 8000-ft. cabin altitude regardless of flight altitude; windows perhaps two to four times larger than present ones, with defrosting provisions; and sufficient air exchange to permit pipe and cigar smoking, at least in the lounge.
• Complete self-contained air conditioning in flight and on the ground even if main powerplants are operating; 80-deg. maximum and 65-deg. minimum cabin temperature regardless of outside conditions; and thermal anti-icing of all surfaces.

▶ **Crew**—Harris said the plane should have a five-man crew—two cabin attendants, and three pilots who also would be qualified navigators. A flight engineer would be required if the plane has reciprocating engines.

Pilot-operated radio-telephone would be used; and the plane would have airborne radar to avoid storms. Pilots' compartment would be suitably air conditioned. One sleeperette chair would be available for crew rest.

▶ **Performance**—Harris said the plane should be able to operate nonstop in either direction between New York and London with a full load, "and the faster the better." It should require not more than 6000 ft. for takeoff and landing at either airport.

It would be able to reach an airport from any point enroute after loss of 50 percent power. There would be a minimum of man-hours for any mechanical operation.

Harris said that to utilize the plane properly there should be no waiting for landing or takeoff at airports. Straight-in approach and zero-zero landing would be imperative.

EAL Files for Coach Extension

Eastern Air Lines, which already operates New York-New Orleans and New York-Miami air coach service, has followed Delta Air Lines in asking Civil Aeronautics Board permission to start four-cents-a-mile flights between Chicago and Miami.

Capt. E. V. Rickenbacker, EAL president, said the cut-rate schedules would become effective Dec. 1 or as soon thereafter as CAB will permit. One flight daily with 56-passenger DC-4 equipment is to leave Chicago at 11:30 pm. and Miami at 1 am.

▶ **40 Percent Cut**—Eastern's proposed Chicago-Miami coach fare of $47.45 is about 40 percent under the regular first-class one-way rate of $78.80. No food will be served on the coach flights, and reservations will be made when the ticket is purchased.

Delta Air Lines last month asked CAB approval for a $49.85 coach rate between Chicago and Miami starting Dec. 16. Delta's low-fare flights would also be with 56-passenger DC-4s. The DAL planes would leave both terminals earlier than EAL's but would make intermediate stops at Cincinnati, Atlanta and Jacksonville.

SHORTLINES

▶ **BOAC**—Has dismissed 14 executives and an estimated 1000 employes in a move to cut its deficit which totaled 5,844,000 pounds (about $23.5 million under the old rate of exchange) for the year ended last Mar. 31.

▶ **Continental** – In cooperation with CAA has begun large-scale testing of VOR (omni-directional radio range) transmitters recently installed along the carrier's 3000-mile system.

▶ **Delta**—Has asked CAB for a certificate amendment to authorize service between Dallas and Houston and between Beaumont-Port Arthur, Tex., and Alexandria, La.

▶ **Hawaiian Airlines**—Has asked CAB for a mail pay increase to offset future traffic losses to Trans-Pacific Airlines. TPA was certificated to carry intra-island passengers and cargo last February and started service competitive with HAL in June. During July and August, HAL earned about $87,000, while TPA lost $60,000.

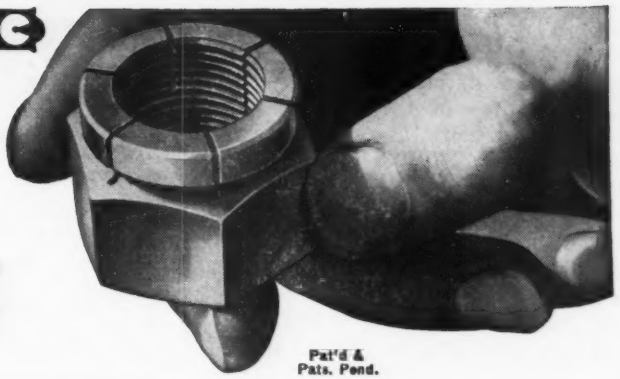
▶ **Monarch**—Together with Arizona Airways has asked CAB for a temporary exemption to permit MAL to operate routes between Gallup, N. Mex., and Douglas, Ariz., and between Phoenix and Yuma pending disposition of the Arizona Airways-Monarch merger case.

▶ **Northeast** – CAB has extended through Oct. 23, 1950, the deadline by which Atlas Corp. will be required to dispose of all its shares of common and convertible preferred stock of Northeast in excess of 3 percent.

▶ **Pan American**—CAB has approved for three years the interlocking relationship whereby Sherman M. Fairchild serves as a director of both PAA and Fairchild Engine & Airplane Corp.

FLEXLOC

SELF-LOCKING NUTS FOR THE AIRCRAFT INDUSTRY



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Whether it's mass production of popular light planes, air transports, or building of experimental planes for the Army and Navy, reliability of construction is a must. FLEXLOC, with its resilient, flexible segments comprising the "self-locking" feature, won't shake loose even under the most chattering vibration. And FLEXLOC has unusually uniform torque—within a few "inch lbs.". Made in one solid piece, FLEXLOC is a stop, a lock and plain nut all in one, and is available in "thin" types as well as the "regular"—in NC and NF thread series.

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All ARC Airborne equipment is Type Certificated by CAA. It is designed for reliability and performance—not to meet a price. Write for further details or name of your nearest ARC representative.

ARC Aircraft Radio Corporation

BOONTON, NEW JERSEY

DEPENDABLE ELECTRONIC EQUIPMENT SINCE 1928

▶ **Seaboard & Western**—Carried a record 211,432 lb. of export freight out of the U. S. during September. It was the first time in the company's 29-month operational history that export traffic topped 200,000 lb. Total September traffic was 521,261 ton miles, up 113 percent over the same month last year. During the month S&W completed its 750th trans-Atlantic crossing and topped the 10 million ton-mile mark in freight carried between the U. S., Europe and the Middle East.

▶ **Southwest**—Will add two 27-passenger DC-3s to its feeder fleet next spring and convert its present nine DC-3s to the same specifications. The new interiors were designed by SWA, and the conversion is being handled in the company's San Francisco Airport shops. Southwest says it is now doing general overhaul and maintenance work for several airlines and that facilities are available to do the special DC-3 conversion for other carriers.

▶ **TWA**—Has maintained an average 80.5 percent load factor on its New York-Pittsburgh-Chicago and Kansas City-Los Angeles air coach operations since the cut-rate flights began.

▶ **United**—New winter schedules inaugurated Nov. 1 are the most extensive ever operated by UAL and will provide 11 percent more available seat miles than last winter. . . . Company has joined Pan American Airways in asking CAB approval of reduced-rate books of 20 commuter tickets between California and Honolulu.

▶ **Wisconsin Central**—Mail rate for the period Feb. 24, 1948, to July 31, 1949, has been increased by $85,000 because of the company's critical financial condition, bringing total payments to $1,193,410, or 74.25 cents a plane mile.

CAB SCHEDULE

Nov. 14—Prehearing conference on Monarch-Challenger merger. (Docket 4129)

Nov. 13—Oral argument on Delta Air Lines' request to serve Chattanooga as an intermediate point between Knoxville, Tenn., and Atlanta. (Docket 3297)

Nov. 21—Oral argument on Pan American Airways' proposed Guatemala City-Los Angeles-San Francisco service. (Docket 3277)

Nov. 28—Hearing on transcontinental coach-type service. Postponed from Nov. 16. (Docket 3397 et al)

Dec. 5—Hearing in Western-Inland mail rate case. (Docket 2870)

Dec. 6—Hearing on renewal of Trans-Texas Airways' feeder certificate. (Docket 3720)

Dec. 19—Hearing in Florida Airways mail rate case. (Docket 3695)

Jan. 4—Hearing in National Airlines route transfer case. (Docket 3500)

Jan. 9—Hearing in New York City area helicopter case. Postponed from Dec. 5. (Docket 946 et al)

Jan. 9—Hearing on air freight accumulation, assembly and distribution tariffs. (Docket 1705 et al)

Feb. 6—Hearing in Colonial Airlines mail rate case. (Docket 2724)

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AIR TRANSPORTATION Purdue University Graduate desires position in aviation field in sales, management, cargo or passenger traffic. Broad technical economics and business background. Single, locate anywhere. PW-1368, Aviation Week.

POSITIONS WANTED

FLIGHT ENGINEER—Pilot—Mechanic A and E-3000 hrs. flight engineer experience; airlines and factory; 3000 accident free hrs as pilot. Commercial license single-multi engine land, sea and flight instructor ratings. A and E Mechanic, 9 yrs. experience. Desire position as pilot or pilot mechanic for corporation, or Flight Engineer on Certificated Airline. PW-1304, Aviation Week.

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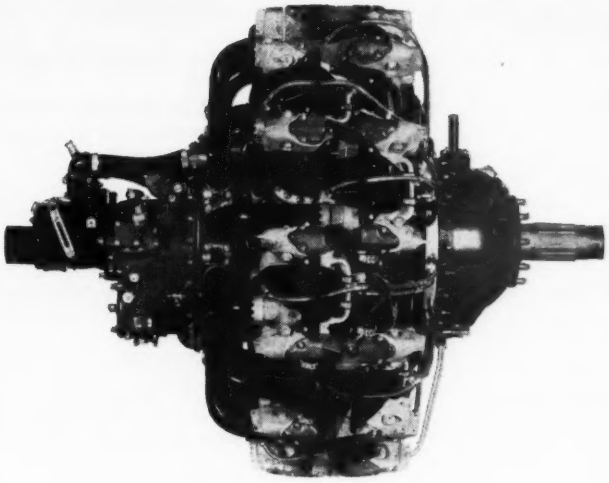

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All engines arriving at the PAC receiving department are thoroughly checked for rust, corrosion and other conditions. Care is exercised in determining effect of transit. Even smallest parts included in shipping are accounted for.

For reasons of efficiency, which speeds up delivery and keeps PAC commercial overhaul prices far below average, each engine is precleaned before disassembly starts.

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PAC cleaning methods are famous for thoroughness, include sand blasting, vapor blasting, and vapor degreasing. Seed blasting is used for cleaning cylinders and other precision surfaces, a method which protects the most delicate metals.

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Every inspection device known to aeronautical science closely "eyes" each part. Magnaflux inspection of ferrous parts, and Zyglo inspection of non-ferrous parts is a routine must in all conditions. Electric systems are given exacting laboratory tests. PAC has created much of the inspection and test equipment used in its shops and the aviation industry in general. No greater provisions for quality are made anywhere in the industry.

All repairs are made to manufacturer and CAA specifications. Silver, tin, copper, lead and cadmium plating is applied to all parts as required. The PAC plating department is one of the most modern in the world.

Replacement parts are from PAC's own large stocks of Pratt & Whitney, Bendix, Stromberg, and other nationally famous lines, many of which are distributed by PAC. Latest manufacturer and CAA specifications are followed in selecting and installing replacements. A PAC commercial overhaul means that the engine is ready to deliver rated power. Economical operation is assured—economy which also includes PAC low prices.

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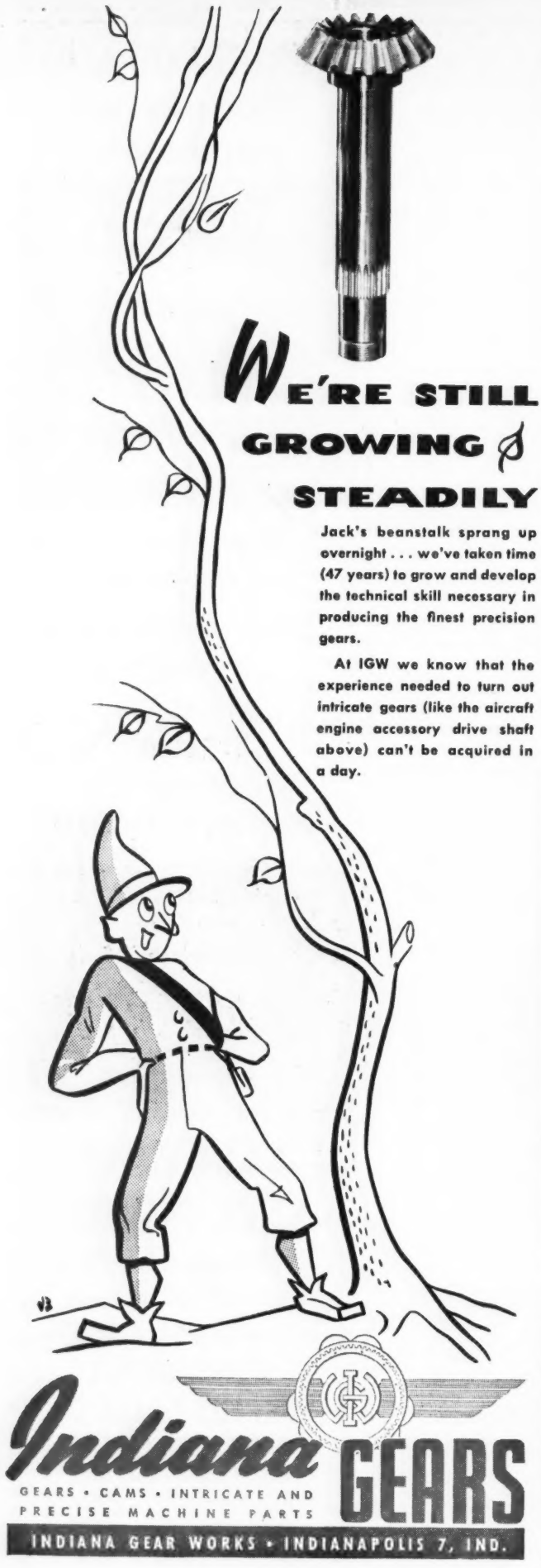
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STRICTLY PERSONAL

WATCH THAT FRENCH MERCHANDISE—Pan American's News Bureau Manager, **John Creedy,** describes a job that was "the answer to a flight crew's prayer." It was a recent PAA charter of two planes for a coast-to-coast tour to publicize the products of Lever Bros. and Harriet Hubbard Ayer. A C-46 hauled the props for the show and a Convair carried the precious personnel, including—ooh, la la—nine beauteous (live) French models. In the course of the junket, the traffic dept. received the following telegram from its Boston office:

"TO PROTECT FUTURE RELATIONS WITH LEVER AND AYER STRONGLY SUGGEST PROPER CHANNELS BE USED TO CAUTION CREW DO NOTHING PERSONALLY TO DAMAGE FRENCH MERCHANDISE ENTRUSTED TO THEIR CARE STOP LEVER AND AYER WORRIED ACCOUNT CONTRACT WITH COUTURIERS OF PARIS TO RETURN MERCHANDISE TO PARIS IN SAME CONDITION AS RECEIVED STOP NEW ENGLAND EXPRESSION QUOTE NEVER SINK A GRAVY BOAT UNQUOTE CLOSELY RELATED IN THIS CASE TO QUAINT FOLKLORE ADAGE ABOUT FILLING YOUR PEN IN COMPANY INKWELLS."

* * *

CAUGHT WITH HIS . . .—Delta's office gang in Birmingham tell about the man who phoned he'd left his trousers on the airplane in care of the stewardess and would they please take care of them as he'd forgotten them. (It seems it was an extra pair on a hanger, of course.)

* * *

TURNER'S FOUR WHEEL BRAKES—Another story from Delta Air Lines reports the laughter over **Jim Turner,** assistant superintendent of maintenance, and his fire-running episode about 4 one recent morning. He was awakened and told about a fire at the maintenance base. Although firemen were already there, Turner sleepily hurried outside and jumped into his trusty motor car. Only then did he remember that all four wheels had been removed the night before for his own private overhaul job.

* * *

A BLIMP AND AN UPTURN—**Hank Lefer,** our makeup editor whose name mysteriously appeared upside-down on Page 4 of our Oct. 31 issue, recalls the first time right after Pearl Harbor that a rural lady spotter saw a blimp from one of the many new observation posts and frantically reported to the filter center: "Seen—one submarine, flying low—one mile north of observation post."

As for Hank's upset, it appears a makeup man just dropped the slug wrong-side up. We never fully realized AVIATION WEEK's readership within McGraw-Hill alone until everyone from **Curtis McGraw** on down the line began heckling us. The name was OK on the page proofs we approved.

* * *

HOW TO MAKE FRIENDS WITH THE BOSS—According to **Warren Smith,** Fairchild's new President **Dick Boutelle** was demonstrating one of his prize antique guns to some cronies at his fine old Maryland farm the other day. He handed the thing to **Len Povey** and said, "Here, you shoot it." Povey fired the first barrel, which went off like the opening gun on D-Day. The second barrel fizzled.

"What do I do now?" Povey asked. "Crack it," advised Dick. Aiming carefully away from the other guests, Povey did as he was told. Barrel 2 went off and bam—one of Boutelle's prized drakes hit the dust. In the ensuing confusion they somehow managed to end the drake's suffering and slap him into the deep freeze. —R.H.W.

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EDITORIAL

Telling the World About U. S. Air Power

U. S. aircraft and power plant manufacturers, threatened with stiffer competition from the British in world markets, should be studying more aggressive sales devices both here and abroad.

Certainly, U. S. industry is at work on new projects and improved versions of currently publicized models. But there is danger that overcautious "security" regulations imposed by one or both of the American air services will prevent adequate journalistic reporting on this dynamic and vital front.

While it is all very well for our generals and our admirals to keep the wraps on their newest weapons, let's not forget that in a democracy it is the taxpayer who buys those weapons. If we can sell air power to the taxpayer, we have less to fear from government administrations like Mr. Truman's, which seeks to impose budget cuts on our Air Forces despite the expressed will of the Congress to the contrary.

The United States needs some safe and impressive manifestation of air power for the people. American observers, both civil and military, who attended the 10th annual exhibition and flying display of the Society of British Aircraft Constructors last September at Farnborough were impressed by the event as a commercial showcase for British aviation and focal point for arousing general public interest in British air power.

The SBAC show was attended by about 6000 foreign technical observers representing potential customers for both civil and military wares, in addition to attracting about 250,000 paid admissions on the two days the show was open to the public. Most foreign observers agreed that the British manufacturers and their pilots put on a superb show that gave an impact to recent British announcements of their aeronautical progress that could never have been summoned without a concentrated demonstration of this type.

The flying was spectacular enough to draw the public but it was also sufficiently sophisticated to give the foreign technical observers a good idea of what the British planes had to offer.

The SBAC show is financed entirely by the British manufacturers. There is no government financial aid. In fact, the government actually receives a hefty fee from the Farnborough show for rent of the field and hangars to SBAC. The final tab for the show is usually written in red ink and the British manufacturers regard it as part of their sales investment.

Both Royal Air Force and Ministry of Supply cooperate in allowing manufacturers to exhibit and demonstrate the latest military models with company pilots rather than with military personnel. Each year several military types are removed from the secret list to make their debut at Farnborough. The first three days of the show are restricted to guests, most of whom are invited and sponsored by individual manufacturers exhibiting at the show.

Individual firms arrange to complement the show with tours of their factories for their prospective customers, where business can be discussed. On the final two days (Saturday and Sunday) the show is open to the public at a nominal admission price.

The American aircraft industry made a start in this direction in the fall of 1946 with the National Air Show at Cleveland. Combination of a financial loss plus the beginning of the postwar tailspin in aviation cancelled a repeat performance scheduled for 1947. Any program of this sort should be begun as a long-term proposition with the realistic understanding that its losses be underwritten as part of sales and public relations expenses. The first show should be regarded only as a beginning with sufficient flexibility arranged for continuous improvement and tailoring to meet the changing needs of the industry. The show should have continuity from year to year but it should never be hidebound by tradition.

The initial effort at Cleveland left ample room for improvement. In addition to flight demonstrations of individual aircraft, as at Farnborough, some of the mass military aviation demonstrations that have enlivened the postwar National Air Race program, could be a strong attraction.

The Aircraft Industries Assn., sponsor of the 1946 show, is certainly the proper group to take the initiative in reviving and improving such a display. AIA has an array of high-priced public relations talent to do the spade work, and individual manufacturers would be on their toes to produce the best exhibits possible for their firms, if the U. S. Air Force and Navy Air not only cleared the project but participated fully in this national demonstration of air power.

Bendix Products Division

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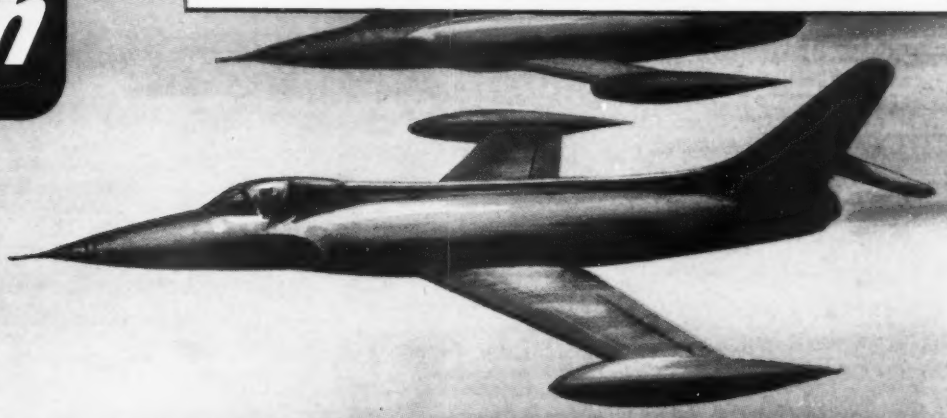

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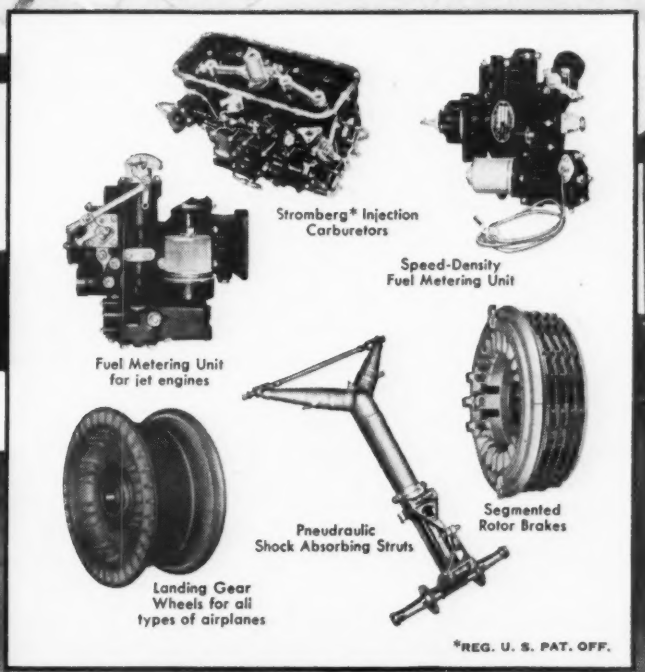
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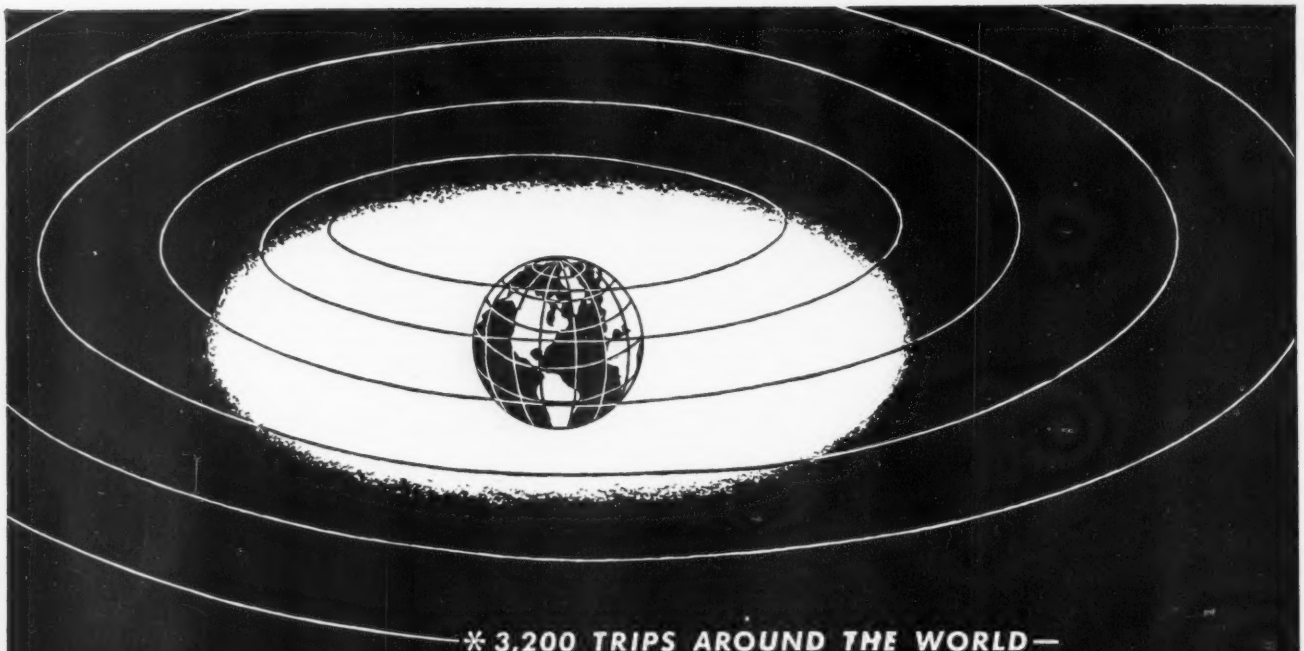

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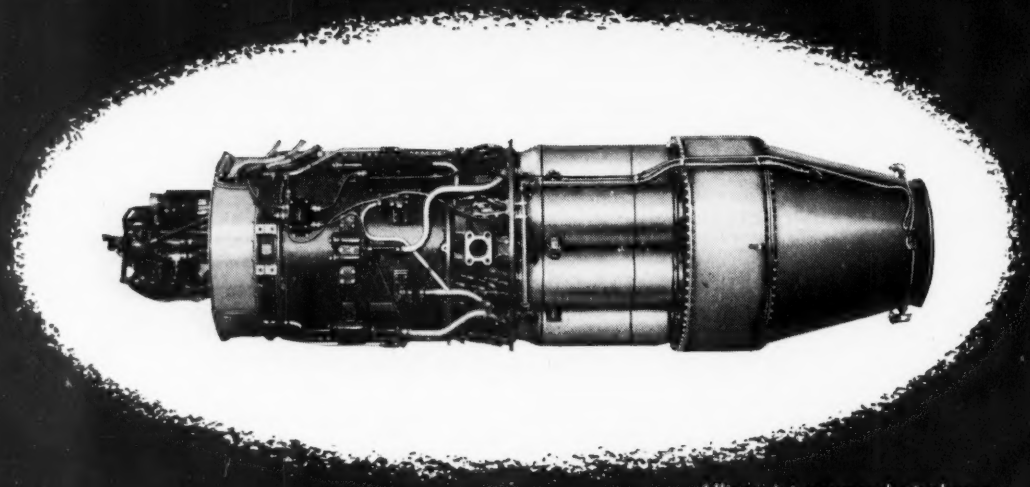

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